EXHIBIT A

SUPPLEMENTAL EXPERT REPORT ON ALLOCATION WITH RESPECT TO EXXON'S BAYTOWN AND BATON ROUGE REFINERY AND CHEMICAL COMPLEXES

MATTHEW A. LOW

January 30, 2017

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I. INTRODUCTION

This report supplements my reports dated August 10, 2012, and November 16, 2012, my deposition testimony, and my declaration dated December 20, 2013, in support of the government's motion for summary judgement. The purpose of this supplemental report is to address and take into account the following in my allocation analysis:

- The Court's June 4, 2015, Memorandum and Opinion ("SJ Opinion") on summary judgement motions filed by the U.S. and Exxon;
- Revisions to Exxon's claimed costs, which include reduced costs for certain claimed units and increased costs for other claimed units;
- Additions to the record, in both these CERCLA cases and in the related contract cases in the Court of Federal Claims, which include documents, expert witness reports, declarations and depositions, all added to the record after my earlier analysis; and
- The statements of Mr. Richard White and other Exxon experts in their declarations submitted with Exxon's summary judgment motion and the recently submitted expert report of Gregory Kipp.

Attachment 1 is a list of documents I have relied on or considered for this report.

II. SUMMARY OF REPORT AND SUPPLEMENTAL OPINIONS

- In Section III, I discuss aspects of the SJ Opinion that I believe impact the allocation analysis.
- In Section IV, I discuss the response cost impact on claimed costs of government-owned and co-operated plants during 1942-1955 in light of the SJ Opinion. In my opinion, it is reasonable to increase the government share of the response cost impact of government-owned plants from 50% to 62.5% to take into account the Court's opinion that the government was also an operator of the government-owned plants. I also have recalculated the response cost impact of government-owned plants as a function of crude throughput percent at both Baytown (increasing it from 5% to 7%) and Baton Rouge (decreasing it from 4% to 2%).

- In Section V, I discuss the potential ramifications of the Court's opinion that the government was not an operator of the Baytown and Baton Rouge refineries, but that at each complex, the government-owned plants and the refinery constituted one unified facility. In my opinion, if the Court decides that allocation of a share to the government for refinery operations (as opposed to Plancors and government-owned plants) is warranted, it is reasonable to allocate the government a share of the response cost impact attributed to avgas production and "other war products" during 1942-1945, as I recommended in my August 10, 2012 expert report. Given the Court's findings that the government was not an operator of the refineries as that term is used in CERCLA, it also is reasonable to consider allocating a share that is lower than the 50% that I recommended with respect to avgas and the 40% that I recommended for "other war products." In my opinion, it also is appropriate to allocate the government 0% of the response cost impact of refinery operations during the Korean War period.

- In Section VI, I address statements by Mr. White and Mr. Kipp in support of the use of Mr. White's waste reduction multipliers. My opinion remains that Mr. White's use of these multipliers is not credible. Mr. Kipp's attempt to buttress Mr. White's multipliers as having "scientific logic" ignores important evidence and, more importantly, fails to address the nature of the units or groundwater areas being remediated.

- In Section VII, I discuss modifications to my allocation calculations occasioned by additional cost data and other documentation in the record. I also discuss minor revisions to the calculations attached to my August 10, 2012 report.

The revisions to my allocation calculations discussed in this Supplemental Report do not have a material impact on my overall allocation opinions. In my opinion, the government should not be allocated more than 2%-3% of past costs claimed for Baytown and 1% of past costs claimed for Baton Rouge.

With this report, I also have recreated a working form of Mr. White's allocation model in Microsoft Excel format and transformed my original allocation calculations into this model in order to enable the Court to more easily compare the differences between my analysis and Mr. White's analysis should the Court be interested in this comparison with Mr. White's basic crude-throughput-based framework. Attachment 2 contains the summary and calculation sheets for Baytown. Attachment 3 contains the summary and calculation sheets for Baton Rouge. These calculations assume all of Exxon's claimed costs are recoverable. I am aware that government experts will be filing reports addressing how much of these claimed costs are recoverable under CERCLA – and these determinations, if incorporated in my analysis, could result in revised allocation percentages.

III. SUMMARY JUDGMENT OPINION

Of most relevance to my allocation analysis are the Court's findings in the SJ Opinion encapsulated as follows:

For the reasons explained below, the court concludes that: (1) the refineries and plants were sufficiently integrated at each site to be part of the same "facility"; (2) the government was not an "operator" of the refineries at either site; and (3) the government, with Exxon, operated the plants at both sites.

SJ Opinion at 48.

The SJ Opinion recognized that:

> *Because the government has admitted liability as a prior owner of the Plancors at each site, concluding that the Plancors and refineries at each site are one unified "facility" would subject the government to liability for the refineries regardless of whether the government actually operated them.*

SJ Opinion at p. 48

However, consistent with the Court's finding that the government was not an operator of the refineries, the Court also recognized that finding that the Plancors and refinery were one facility would not preclude an allocation that took into account the lesser involvement of the government in refinery operations:

> *This conclusion would not preclude allocating less fault to the government based on lower culpability for wastes generated at the refineries than at the plancors. See Southern Pacific Transp. Co. v. Voluntary Purchasing Grps. Inc., 1997 WL 457510, at *6 (N.D. Tex. Aug. 7, 1997) (noting that the CERCLA defendants' argument that it would "be unfair to hold them liable for response costs for the entire commerce Site based on their ownership of only one parcel" was a "fairness concern [that] may be relevant in a future apportionment or contribution phase of the case, it is not relevant to the initial determination of liability under Section 107(a)").*

SJ Opinion at page 48, footnote 24.

The Court also found that "….operator status with respect to each sub-facility is a factor in allocating fault…" and that "[t]he Phase II determination of how to equitably allocate the remediation costs incurred at each site will be informed by the following analysis, which considers the refineries and the Plancors separately." SJ Opinion at p. 53. The Court cited *Lockheed Martin Corp. v. United States*, 35 F. Supp. 3d 92, 144-45 (D.D.C. 2014) for the proposition that "the Supreme Court's definition of operator liability in *Bestfoods* is helpful in delineating the *types of control* over which CERCLA extends and thus which party should be *more* responsible as an equitable matter." SJ Opinion at p. 53. And finally, the Court stated:

> *Accordingly, both parties operated the Baytown and Baton Rouge "facilities" during the time in question. Each party's culpability and extent of liability, which depend in part on whether that party operated particular parts of those facilities, will be decided in the equitable allocation phase.*

SJ Opinion at p. 76.

I take these findings to mean that, on the one hand, the government does not have operator liability under CERCLA with respect to contamination that can be attributed to the operation of refineries, and that it has operator (as well as owner) liability for contamination that can be attributed to the government-owned plants during the periods that the government owned and was a co-operator of the plants. On the other hand, by finding that the government-owned plants and Exxon-owned refineries were sufficiently integrated to be part of the same "facility" under CERCLA, and that both Exxon and the government therefore operated the facilities, the SJ Opinion leaves open to interpretation the extent of government responsibility, if any, for contamination that can be attributed to refinery operations during the time of alleged government involvement (i.e., during WW II and the Korean War and during years of operations of government-owned plants). In other words, how is the lesser fault of the government as it relates to refinery operations and the fact that the Court has not categorized the government as an operator of the refinery proper to be taken into account in allocating responsibility between Exxon and the government for response costs impacts attributed to refinery operations?

The question presented is particularly important because, with the exception of a portion of the Ordnance Works Groundwater Plume, all of the past and known near-term future costs claimed by Exxon in this case relate to contamination in waste units (e.g., impoundments, ditches or canals) and groundwater areas that were within the refinery boundaries and which were impacted primarily by refinery operations associated with the storage and handling of oils and chemicals and the production of refinery products primarily from the processing of crude oil. The direct or indirect contribution of the government-owned plants to contamination in these units or areas was minimal.

IV. ALLOCATION FOR GOVERNMENT-OWNED PLANTS' IMPACT ON CLAIMED RESPONSE COSTS FOR REFINERY UNITS AND GROUNDWATER AREAS – 1942-1955

As noted above, all of the past costs claimed by Exxon are for units or areas of groundwater contamination within the refinery. One apparent ramification of the Court's ruling is that the government would have some responsibility and be allocated a share of the government-owned plants' response cost impacts on units and areas within the refinery.

The first step in the allocation is to determine the response cost impact of refinery and chemical plant operations during the period of government involvement (generally 1942-1955, accounting for both WWII and the Government's continued ownership of certain

rubber/chemical plants at Baytown and Baton Rouge until 1955). That impact is minor[1] in comparison to the impact of the ownership and operation of the refineries by Exxon, which encompass the periods from 1920-present for Baytown and 1910-present for Baton Rouge, as well as Exxon's sole ownership and operation of the chemical plants, starting partially in 1946 and fully in 1955. Once the impact of the overall 1942-1955 period is determined, the issue addressed in this section then is the response cost impact of the government-owned plants during that period and how should that impact be allocated between Exxon and the government.

For the purpose of my August 10, 2012 report, I accepted that the government-owned plants were integrated with the refineries and that the government should be allocated a share of any contamination of refinery units associated with these plants while owned by the government.[2] Thus, I did consider the impact of government-owned plants in my August 10, 2012 expert report.

In light of the court's findings, this supplemental report reexamines the allocation of responsibility to Exxon and the U.S. for response cost impacts of government-owned plants. It also reexamines the extent to which contamination at the refinery units and contaminated groundwater areas claimed by Exxon and the attendant response costs can be attributed to operations of the Plancors and Baytown Ordnance Works Plant while they were under government ownership and jointly operated by Exxon and the government.

A. Allocation for Response Cost Impacts Attributed to Government-Owned Plants

In my August 10, 2012 report, I offered the opinion that a reasonable share for the U.S. for the waste load impact from the Plancors is 50% based on the fact that the U.S. funded construction of and owned the plants, and Exxon operated and was in a position to derive profits from the plants.[3] While, in my experience, the operator of a manufacturing facility more often receives a higher than 50% share when allocating between the operator and owner, I believed that a 50/50 division was reasonable given the facts relating to each party's involvement with these plants. I did not base my allocation on owner/operator classifications, but considered that both parties were significantly involved and benefitted from the plants. That is still the case, but the Court's finding that the government also was an operator of the government-owned plants does somewhat modify the assumptions underlying my original allocation. If the Court decides that it is appropriate to consider party's status as an "operator" under CERCLA in determining an equitable allocation, in my opinion, it would be reasonable to modify the share allocated to

[1] As will be discussed in detail in Section VI, this is particularly true at Baton Rouge, where the waste impoundments for which the majority of costs are claimed were not used until after the end of WW II – meaning that the impact of the 1942-1945 period was close to nonexistent. And the portions of these units that are actually subject to remediation were not used until the 1950s, and then, were used, even more extensively, in the 1970s and 1980s.

[2] Low August 10, 2012 Report at p. 10.

[3] Id. at pp. 28, 29.

the government for these plants. In looking at this in the context of owner/operator allocation, in my opinion, it is reasonable to split the operator share 50/50 between the government and Exxon.[4] In my opinion when allocating between an owner and an operator, a reasonable owner share is 25% and a reasonable operator share is 75%. Splitting the operator share results in a government share of 25% + (50% x 75%) or 62.5% for impacts from government-owned and co-operated plants.[5]

At Baytown, one of the plants, Plancor 877, was not operated by Exxon. Accordingly, for the purpose of this allocation, the government can reasonably be allocated the entire share for this plant during the 1942-1955 period. As discussed further below, the impact of Plancor 877 on contamination at the refinery relative to the other government-owned plants is about 12%. Taking into account this impact increases the total government share for all Plancors to 67% for the 1944-1955 period during which Plancor 877 was in operation, calculated as follows:.

	Govt. % Individual Plancors	Response Cost Impact %	Total Govt. % for all Plancors
Plancor 877	100.00%	12%	12.00%
Other Plancors	62.50%	88%	55.00%
			67.00%

[4] I am aware that Exxon has asserted that the government is an "arranger" with respect to the Hydrocodimer plant (Plancor 1909) at the Baytown facility and that the Court has reserved judgment on this issue to Phase II. SJ Opinion at p. 73, fn. 34. As discussed further below, the Hydrocodimer plant was operated for only one year and there is no estimate of its contribution to the refinery waste load. As Dr. Kittrell has noted in his expert report: "As almost the entire amount of feedstocks charging this Plancor came from other refineries, the wastes associated with processing of crudes to provide this feedstock would not have been a contributor to sediment, sludge or waste contamination at the Baytown site." Kittrell November 16, 2012 Report at p. 61. Given the limited period of operation and limited and unquantifiable impact of wastes from this plant, whether the government is found to be an arranger of this plant has no impact on my opinion on the percentage allocated to the government for the government-owned plants for the period 1942-1955.

[5] I note that after WW II ended, the government's degree of involvement in the government-owned plants probably was reduced (e.g., after the government rubber contracts ended, the government's involvement government restrictions were more related to its ownership and the plants were used by Exxon for Exxon's commercial production), which might suggest that the government could be allocated a lesser percentage of the operator share or, possibly, only an owner share, for these plants after WW II. However, since the Court has not drawn such a distinction in its initial opinion, I have not reduced the government share for periods of government ownership after 1945.

B. Response Cost Impacts of Government-Owned Plants at Baytown

The issue here is the response cost impact of the government-owned plants during 1942-1955 in comparison to the operation of the refineries. As discussed in more detail below, these impacts can be attributed to:

- The percentage of crude throughput that can be attributed to production of raw materials for the government-owned plants;[6] and

- The extent to which byproducts or wastes from the government-owned plants were returned to the refinery for processing.[7]

1. Baytown Government-Owned Plants

At Baytown for a period of time, there were five government-owned plants -- four Plancors and the Baytown Ordnance Works:

- Plancor 1909 – Hydrocodimer Plant – This plant operated under government ownership for only one year from August 1944 to August of 1945 and was sold to Exxon in 1946. As conceded by the Government and found by the Court, this plant was within the refinery complex and it appears that any wastes that may have been generated by this particular plant would have been processed in the refinery waste stream. I am unaware of any documents produced by Exxon that would enable quantification of the volume of any waste streams from this plant, and, given the short period of its operation, its overall impact on the response costs at issue in this matter would seem to be negligible.[8]

- Plancor 485 – Butadiene Plant -- This plant operated from August 1943 to April 1955 under government ownership when it was purchased by Exxon. It was located outside the refinery complex. A report to the Reconstruction Finance Committee (RFC) in 1946 indicated that approximately 740 gallons per minute (gpm) of oil emulsions and one other waste stream of 15-20 gpm of condensate containing 1%-2% alcohol from the Butadiene plant were being temporarily processed at the refinery at that time.[9] Documents in the record suggest that the emulsion waste stream was being conveyed to the refinery as of

[6] See discussion, below. Dr. Kittrell has estimated the percentage of crude throughput that can be attributed to production of raw materials for government-owned plants. Kittrell November 12, 2012 Report at p. 59. I have incorporated Dr. Kittrell's estimates into my calculations of the response cost impact of the government-owned plants during 1942-1955.

[7] See discussion, below. The only quantified waste stream sent to refinery was an emulsion from the Butadiene pant.

[8] See footnote 4.

[9] Shephard Powell, Report to the RFC on Industrial Wastes RuR SR-10, July 26, 1946. BAYHIS-00006438.

approximately February 1944. According to a 1949 flow diagram contained in an Exxon document, this emulsion waste stream (then estimated at 680 gpm) was still being conveyed to the refinery as of June 1949 as well as a waste stream of 150 gallons per hour (gph)[10] from an alcohol stripper as indicated on a revised waste flow diagram[11] associated with estimates for other modifications to the Plancors. This document might suggest a more permanent arrangement, although I am not aware of any other documents that show the waste flow from the Butadiene plant continuing after 1949. Other flows from the Butadiene plant also were mentioned in the 1946 report, such as oil slop sent to the refinery for treatment and reuse and sludge from the Plancor's separator which was disposed in the Refinery North Tank Area for burning, but these were not indicated on the same 1949 flow diagram which showed the emulsion waste stream still being sent to the refinery.[12]

- Plancor 1082 – Butyl Rubber Plant -- This plant operated under government ownership from February 1944 to April 1955 when it was purchased by Exxon. It was located outside the refinery complex. A report to the Reconstruction Finance Committee (RFC) in 1946 shows that naphtha skimmings from the slop tank were pumped from this plant to the refinery for treatment and reuse[13] and may have contributed to the refinery waste stream. However, I am not aware of any documents quantifying the amount of waste that would have been generated from processing these naphtha skimmings for reuse. These skimmings are not shown the 1949 waste flow diagram discussed above.[14]

- Plancor 877 – Copolymer Plant -- This plant operated under government ownership from July 1943 to May 1955 when it was sold by the government. It was located outside the refinery complex. Dr. Kittrell has estimated the percentage of the crude throughput that can be attributed to production of raw materials for this plant. However, like Plancors 485 and 1082, it had its own waste processing system and a common outfall with those pants, and I am unaware of any evidence that wastes from this plant were processed in the refinery waste processing system or that any byproducts were sent to the refinery for treatment or reuse.

- Baytown Ordnance Works – Toluene Plant -- This plant operated under government ownership from September 1941 to June 1946, when it was purchased by Exxon. It was located adjacent to the refinery complex. The Court has found that, "[a]lthough most of

[10] Mr. Gravel misreports this stream as 150 gallons per minute (gpm) in his June 2012 expert report. June 18, 2012 Gravel Report at p. 106.

[11] June 2, 1949 Estimate No. 7222. BAYC-00003367, at 373.

[12] Id.

[13] Shephard Powell, Report to the RFC on Industrial Wastes RuR SR-43," July 26, 1946, BAYHIS-00006388.

[14] June 2, 1949 Estimate No. 7222. BAYC-00003367, at 373.

the Ordnance Works infrastructure was outside the Baytown refinery's boundary, the Works exchanged byproducts with the refinery, used the refinery's waste-processing facilities for its wastewaters, and shared a waste-drainage ditch that fed into the Houston Ship Channel. (*Id.* ¶ 141)."[15] Dr. Kittrell has estimated the percentage of crude throughput that can be attributed to production of raw materials for this plant. However, I am unaware of documents that would allow a quantification of wastes that would have been generated at the refinery from Ordnance Works wastewaters or processing of Ordnance Works byproducts into petroleum products.

2. Calculation of Response Cost Impacts of Government-Owned Plants in My August 10, 2012 Report

In my August 10 2012 report, I calculated a maximum potential refinery waste load impact of 8% for the years 1944 and 1945 – which averaged out to 4% for the 1942-1945 period and 5.3% for the 1946-1955 period. Averaging these shares out produced a 4.93% impact which I rounded up to 5.0% for the full 1942-1955 period for the purpose of my allocation analysis.[16] This was based primarily on the Plancor 485 emulsion waste stream (reported as between 680 gpm in 1949 and 740 gpm in 1946) which I rounded up to 800 gpm to take into account possible waste load impacts from the hydrocodimer plant waste stream (for only one year) and from treatment and reuse of byproducts and oil skimmings from the government-owned plants during their periods of government ownership. It was also based on an assumed average total refinery waste system discharge of 10,000 gpm during 1942-1945 and 15,000 gpm during 1946-1955. [17]

Waste load impact has the most relevance to the claimed units that were part of the refinery waste processing system – a series of ditches, sewers, and separators ultimately terminating in outfalls to the Houston Ship Channel. The pertinent cost groups claimed by Exxon include Separator 10, Separator 3M, Upper and Lower Outfall Canals and, indirectly, the South Landfarm (which received soils and sludge from closure of the Separators in the 1980s). The extent to which the government-owned plants contributed to contamination in other units claimed by Exxon, such as the four areas of groundwater contamination, the Velasco Ditch, and Mitchell Point, is less clear.

Exxon's expert, Mr. Gravel, noted that Plume Area 4 was in the vicinity of Ordnance Works off-site tanks and pipelines as well as Plancor 1909 production, pipelines and support

[15] SJ Opinion at p.19. The BOW obtained at least some of the naphtha it used as a raw material from the refinery. Undated, Baytown Ordnance Works, General Description and Features. "Charge for the Toluene Plant consists of a clean, closely fractionated, non-corrosive virgin naphtha…..This naphtha cut is taken from various crudes coming into the Humble Oil and Refining Company refinery." US-BT000043.

[16] Low August 12 2012 Report at pp. 28, 29.

[17] Mr. White assumed that the waste load impact of government-owned plants on the refinery waste system was 10%, from 1944-1954 and 5% in 1955. Mr. White provided no calculation or explanation for this assumption in his report. June 18, 2012 Richard White Report at p. 63, fn. 140. His assumption calculates to an average annual waste load impact of 8.2% for the total period 1942-1955.

facilities.[18] He also noted that there some pipelines in the vicinity of Plume Areas 1, 2 and 3 received or distributed materials related to the Plancors and Ordnance Works.[19] However, as noted above, the Hydrocodimer plant only operated for a single year, and the Ordnance Works plant was sold to Exxon in early 1946. Thus, during most of 1946 through 1955, the Hydrocodimer plant's and Ordnance Works' impacts, if any, on refinery groundwater plumes claimed by Exxon are not attributable to the government. For most of 1946 through early 1955, that leaves only the three Rubber Plancors, as discussed more extensively above, and Mr. Gravel does not indicate the extent to which these plants would have impacted groundwater, Mitchell Point or the Velasco Ditch. Notwithstanding the lack of evidence of the impacts on certain units, in my August 12, 2012 Report, I assumed that the 5% impact on the refinery waste load during the years 1942-1955 also applied to all costs claimed by units for refinery units or groundwater plumes.

3. Revised Calculation of Response Cost Impacts of Government-Owned Plants

Based on a reexamination of the record, I have refined my analysis of the percentage impact of the government-owned plants during the period 1942-1955 as follows:

- I have taken into account Dr. Kittrell's opinion that the materials used by the three Rubber Reserve Plancors were generated from approximately 2.2% of the Baytown Crude Run[20] – assuming this percentage for the years 1944-1954 when all three plants were in operation and prorating for the periods during 1943 when the plants first commenced operations and the first few months of 1955, before the plants were sold by the government. This has the effect of raising the share attributed to the United States to account for wastes associated with the distillation and processing of this portion of the refinery crude stream.

- I have taken into account, in similar fashion, Dr. Kittrell's opinion that the materials used by the Baytown Ordnance Works were generated from approximately 2.8% of the Baytown Crude Run[21] -- assuming this percentage for the years 1942-1945 when it was in full operation and prorating for late 1941 when the plant commenced operation and the approximately first half of 1946, before it was sold to Exxon.

- As of February 1944, the emulsion waste stream from Plancor 485 began to be processed at the refinery. I have assumed this waste stream was processed through April 1955 – the period of government-ownership, although I am not aware of evidence that this waste stream was processed at the refinery after 1949. The present state of the evidence in the record suggests that refinery waste load during the 1942-1945 and 1946-1955 periods

[18] June 18 2012 Gravel Report at pp. 124, 125.

[19] Id. at p. 128.

[20] Kittrell November 12, 2012 Report, page 59.

[21] Id.

was greater than the 10,000 gpm and 15,000 gpm, respectively, that I assumed in my August 10, 2012 report. Estimates from the record indicate that the refinery waste flow was 30 million gallons per day through the period 1955, which equates to 28,800 gpm. Using this estimate of waste flow results in a decrease in the percentage contribution attributed to the waste streams from the Butadiene Plant to approximately 4% during 1944-1955.

- In August 1943, Plancor 485 commenced operations. The impact of the refinery's treatment and reuse of oil skimmings from this plant has not been quantified. Plancor 1082 commenced operations in February 1944. The impact of the refinery's treatment and reuse of oil skimmings from this plant has not been quantified. Plancor 1909 came on line in August 1944 and ceased operations in August 1945. Its impact on the refinery waste system units or on groundwater contamination has not been quantified. No quantification has been made of any other waste streams generated or byproducts, such as oil skimmings, produced by these government-owned plants and sent to the refinery for processing or treatment, although I am unaware of any evidence that they were significant. However, as noted below, I have taken into account such potential impacts by increasing the calculated shares for Baytown and Baton Rouge.

The calculations of the impact of government-owned plants as a function of crude throughput percent from this examination are shown in Attachment 4. The results are shown below for each year 1941-1955:

	Crude Throughput %
1941	**0.47%**
1942	**2.80%**
1943	**3.13%**
1944	**8.22%**
1945	**9.00%**
1946	**7.60%**
1947	**6.20%**
1948	**6.20%**
1949	**6.20%**
1950	**6.20%**
1951	**6.20%**
1952	**6.20%**
1953	**6.20%**
1954	**6.20%**
1955	**2.12%**

The average crude throughput percentage impact for the period 1942-1955 is 5.89%. I propose to use 7% in my allocation calculations in order to account for any unquantified impacts.

C. Response Cost Impacts of Government-Owned Plants at Baton Rouge

Six government-owned facilities associated with the Baton Rouge refinery were operated sporadically during the World War II period and thereafter, and four of them ceased operations by June of 1948. Because of their number and sporadic operating histories, they are outlined in the following table:

Plancor	Products	US Ownership	Start Production	End Production	Sale	To Whom
152	Butadiene	land and facilities	4/13/1943	8/6/1947	4/21/1955	Copolymer Corporation
			9/20/1950	4/21/1955		
572	Isobutylene extraction	land and facilities, after 4/20/42	12/5/1942	4/21/1955	4/21/1955	Exxon
	Polymer		1/6/1943	4/21/1955		
	Butyl Rubber		3/6/1943	4/21/1955		
1526	Dehydrogenation Catalyst No. 1707 butadiene manufacture	land and facilities	12/1/1943	3/31/1944	1950	Plant dismantled and equipment sold by June 1950. Property transferred to Plancor 572 in June 1950
1355	Butadiene	equipment and facilities (land owned by Exxon)	3/22/1943	12/31/1948	1/1/1949	Exxon
1065	Avgas Components	land and facilities	5/1/1944	5/9/1945	10/20/1950	Exxon
1868	Xylidene	facilities U.S. owned; land leased by Exxon to U.S.	12/7/1943	2/25/1944	10/1/1949	Exxon
	Avgas Components		12/7/1943	9/30/1945		

I am unaware of documents in the record that provide data on the volume of materials or wastes from the Plancors at Baton Rouge that were processed through the refinery and, as such, the record does not provide a basis to quantify any impact on the major refinery waste units (OSP, RPL or SFZ) for which Exxon claims past costs.[22] According to Exxon's experts, all but

[22] The Plancors have discharged into, and have therefore impacted, the Monte Sano Bayou to the north of the refinery beginning when they started operations and continuing to the present. The discharges into the

one of the three Plancors whose liquid waste streams were processed through the refinery ceased operation by the end of 1948:

- Liquid process wastes from Plancor 1355 were handled by the refinery waste processing from March 1943 to December 1948. (69 months)

- Liquid process wastes from Plancor 1868 were handled by the refinery waste processing from December 1943 through February 1944 (Xylidene production) and December 1943 through September 1945 (Avgas production). (4 months and 21 months, respectively)

- Slop oil from Plancor 152 may have been sent to the Refinery for treatment from April 1943 to August 1947 and from September 1950-April 1955. (106 months)

Of the units for which costs are claimed, the OSP and RPL were placed into operation mostly after 1947[23] and groundwater contamination in the shallow fill zone does not stem from government-owned units which were not located in proximity to the shallow fill zone. Thus, there is only the most tenuous tie between the costs claimed by Exxon and refinery operations during WW II and an even more tenuous tie between these costs and operation of the government-owned plants during various periods from 1942-1955.

With respect to the potential response cost impact of the government-owned plants, as I stated in my August 10, 2012 report:[24]

> *In my opinion, evidence in the record provides no basis upon which to determine an impact of the Plancors on most of the refinery waste units (particularly the OSP and RPL) for which Exxon has claimed costs. Taking into account that any impact on the refinery waste processing was sporadic, and did not encompass the entire 1942-1955 time period, I am assuming that the impact was not significant in comparison to the waste load from refinery operations. For the purpose of this report, I have assumed an impact on the refinery waste processing system of 4%, taking into account the possibility that there may have been some impact on one or more of the units for which Exxon is claiming costs.*

I note that Mr. White's allocation analysis did not attribute any contribution or response cost impact from government-owned plants at Baton Rouge on the refinery units for which Exxon is claiming costs. The 4% contribution that I offered in my August 10, 2012 report likely represents an overestimate of the average annual contribution for the years 1942-1955. In reexamining my original estimate, I have taken into account Dr. Kittrell's opinion that the materials used by the three Rubber Reserve Plancors were generated from approximately 1.5%

Monte Sano Bayou are not part of the Refinery waste process system, and there is no present claim in the case for related costs.

[23] The dates and operation of the OSP and RPL are discussed extensively in my August 10, 2012 Report at pp. 31-35 and my November 16, 2012 Report at pp. 12, 13.

[24] Low August 10, 2012 report at p. 39.

of the Baytown Crude Run.[25] Using these figures and the same methodology I applied to Baytown, I have calculated the impact of the government-owned plants as a function of crude throughput percent for the years 1941-1955. The calculations of the impact of government-owned plants as a function of crude throughput percent from this examination are shown in Attachment 5. The results are shown below:

	Crude Throughput %
1941	**0.00%**
1942	**0.07%**
1943	**1.35%**
1944	**1.50%**
1945	**1.50%**
1946	**1.50%**
1947	**1.25%**
1948	**0.90%**
1949	**0.80%**
1950	**1.40%**
1951	**1.40%**
1952	**1.40%**
1953	**1.40%**
1954	**1.40%**
1955	**0.47%**

The average for the period 1943-1955 is 1.25%. I propose to use 2% in my allocation calculations in order to account for any unquantified impacts.

V. ALLOCATION FOR WW II AND KOREAN WAR RFINERY OPERATIONS' IMPACT ON CLAIMED PAST RESPONSE COSTS AT BAYTOWN AND BATON ROUGE

A. Discussion of Previous Opinions

In my August 10, 2012, report, I noted Exxon's assertion that the basis for government liability for contamination contributed by refinery operations was the government involvement during World War II and the 3-year Korean War period, making the U.S. liable as an "operator" during those periods as that term is defined in CERCLA and interpreted in legal precedent. In developing my allocation framework, I assumed that the Court would find the U.S. liable for contamination attributed to some portion of refinery operations during the WWII and Korean War periods, the assumption implicitly based on a Court finding of operator liability for the refinery. I also assumed that the Court would find Exxon liable for refinery operations as both an owner and operator under CERCLA.

[25] Kittrell November 12, 2012 Report, page 59.

In allocating between Exxon and the government for contribution from refinery operations, in my August 10, 2012 report, I did not attempt to allocate shares to either party based on their status as either an owner or an operator under Section 107 (a) of CERCLA. Thus, I did not weigh Exxon's involvement as both an owner and an operator more heavily than the government's involvement as only an operator. Instead, I focused on the extent of government involvement in regard to refinery outputs produced under government contracts that were specifically directed to the WW II and Korean War efforts.[26] For the purpose of my opinion, I accepted that the U.S. was liable and involved during World War II with respect to both the refineries' production of Avgas and other war products,[27] and that it was liable and involved during the Korean War with respect to the production of Avgas.

Based on the above assumptions, in my August 10, 2012 Report, I stated my opinion that, to the extent that the court found the government liable for some component of refinery operations, at most, the government might be allocated a percentage of response cost impacts relating to:

- **the percentage of crude throughput that was Avgas output during the four-year WW II period**: "*In light of the involvement of Exxon as the owner and operator and economic beneficiary of the refinery and the involvement of the U.S. in efforts to optimize the production of Avgas, in my opinion, it would be reasonable to see the World War II relationship as approximating an equal partnership, arms-length arrangement from which both sides benefited. On that basis, in my opinion, it would be reasonable to allocate **50%** to the U.S applied to the Avgas percentage of crude throughput.*[28]

- **the percentage of crude throughput that was "other war products" output during the WW II period**: "*…in my opinion, if the Court concludes that a U.S. share for the impacts of the production of "other wartime" products is appropriate, it should reflect a lower degree of involvement by the U.S. than for Avgas. In my opinion a reasonable*

[26] Low August 10, 2012 Report at p. 2

[27] As I have noted, the facts in this case cannot be compared to other types of plant conversions that occurred during World War II, where the entire output of a facility was entirely converted to production of a specific war product – for example, automobile manufacturing plants being converted entirely to the production of aircraft parts; fireworks plants being converted entirely to the manufacture of military explosives, or commercial shipyards being converted entirely to the manufacture or overhaul of naval ships. By contrast, the refineries in this case continued to operate as they had operated before the war, continued to produce large quantities of products for domestic consumption, as they had before the war and would continue to do thereafter, and profited from both domestic and government sales. Low, November 16, 2012 expert rebuttal report at pp. 14, 15. Thus, the government's involvement in the refinery operations can be said to be, at most, limited to refinery output directed to war products. As the Court noted, both the Baytown and Baton Rouge refineries had an existing infrastructure that provided the capacity to make war products. Both refineries were valuable to the war effort "as is." SJ Opinion at p. 66.

[28] Low August 10, 2012 Report at p. 27.

share would be 40%" applied to the other war products percentage of crude throughput.[29]

- **the percentage of crude throughput that was Avgas output during the three-year Korean War period:** *"… in my opinion, Exxon has not demonstrated that the U.S. should receive a share for Exxon's Avgas production [during the Korean War]. If the court deems the U.S. level of involvement as meriting a share, in light of the more limited involvement of the U.S. the share should not be greater than 25%, applied to the Avgas percentage of crude throughput."*[30]

Thus, while I did not posit a possible legal basis for government CERCLA liability for any of the refinery operations and output during WW II, it was my opinion that, if the government was found liable for contamination and response cost impacts related to refinery operations, at most, the government could be allocated a share related to outputs of Avgas, and possibly other product output sold to the government for wartime use. During WW II, the output of Avgas averaged 14% of crude throughput at Baytown and 19% of crude throughput at Baton Rouge.[31] The output of "other war products" during WW II was about 20% of crude throughput at Baytown and about 25% of crude throughput at Baton Rouge. During the Korean War, the output of Avgas averaged only 1% of crude throughput during the war's three-year timeframe.

B. Revised Opinion Based on Court's Ruling

The Court's ruling that the U.S. was not an operator of the refinery changes an important assumption underlying my August 10, 2012 opinion. The finding that the government's involvement in the refinery did not rise to the level necessary to find it liable as an operator suggests on one hand that the government should not be allocated any share for the contribution to response costs arising from refinery operations (as distinguished from Plancor contributions). On the other hand, the Court's finding that the government is liable for a unified facility, which includes the refinery, suggests that the Court may nevertheless deem it appropriate, from an equitable standpoint, to allocate a share of response costs impacted by refinery operations to the government.

The Court has indicated that an allocation to the government for the "facility" can take into account the lesser fault or culpability of the government for refinery operations. I interpret the Court's finding to mean that even if the government's liability is premised on its status as an owner or operator of the non-refinery portion the facility, from an equitable standpoint, the

[29] Id.

[30] Id. at p. 28

[31] As noted in my August 10, 2012 report, since half of the Avgas produced at each refinery came from the blending of imported raw materials, instead of being processed from crude oil at the refineries, the actual impact on the refinery waste load or contamination being remedied is estimated to be half of the 14% (at Baytown) and 19% (at Baton Rouge) of crude throughput, or 7% and 9.5% at Baytown and Baton Rouge respectively.

government's allocation percentage could take into account that it was not an owner or operator of the refinery portion. As an allocation expert, I recognize that how this lesser involvement might translate into an allocation percentage for contamination attributed to refinery operations is purely within the province of the Court. However, I offer the following observations and opinions for consideration by the court:

1. Government-Owned Plants

Given the Court's observations about refinery/Plancor integration, and the Court's holding in the SJ Opinion that the United States did not participate in operating the refineries at either Baytown or Baton Rouge, it would be reasonable for the Court to choose to allocate an equitable share to the government based solely on the limited contributions of the government-owned plants to the units and areas within the refineries that are the subject of Exxon's claim. Such an allocation would take into account the "integration effect" of the government-owned plants and has already been considered in my original allocation by taking into account their specific impacts on the response costs at issue, as discussed in detail in Section IV, above.

2. Refinery Operations During WW II – Based on Crude Throughput Percentage

If the Court deems it appropriate to allocate a share to the government for response cost impacts from refinery operations for which the government was not an operator, then my opinion remains that the government should only be allocated a share reflecting the response cost impact of the portion of refinery output in which the government can be said to have had some meaningful involvement through contracts and regulation of the wartime economy – namely the production of Avgas during WW II, which was the subject of government involvement directed to increasing its output and, possibly, to a lesser extent, "other war products" during WW II[32] which were sold to the government under contract.[33] This is the approach I recommended in my August 10, 2012 Report and, in my opinion, it is consistent with the Court's SJ Opinion.

By contrast, Exxon proposes a 60% equitable (or, as Mr. White terms it, "inter-class") share to the government for 100% of the refinery output for both WW II and the Korean War

[32] These include products such as surplus components for 100 Octane Aviation Gasoline, Toluene Feed to BOW, Aviation Engine Oils, High V.I. Heavy Duty Engine Oils, Low V.I. Heavy Duty Engine Oils, Navy Diesel Fuel, Special Navy Fuel Oil, and Asphalt. Undated, Production of War Products at Humble Oil & Refining Company's Baytown Refinery. BAYHIS-00004258, 259.

[33] In my opinion, it is reasonable to conclude that Exxon has not demonstrated that the government's involvement in the production of products other than Avgas, even those products that were denoted by Exxon as war products, warrants imposition of an equitable share for the roughly 20%-25% of crude throughput accounted for by these products at the two refineries. As I stated in my August 10, 2010 report, *Exxon has explained that these products were sold by Humble to Standard Oil under their marketing contract or were subject to competitive bids, much like any other product. The record does not contain the contracts between Exxon or Standard Oil and the U.S. for these other products…* Low August 10, 2012 report at p. 27. As such, it does not appear that these products were subject to the sort of influence and regulation present in the Avgas program.

periods, which, in my opinion, appears to be inconsistent with the Court's SJ Opinion.[34] It is difficult to see a sound basis in the record for allocating to the government a share of 100 % of the refinery output during WW II or the Korean War as suggested by Exxon's experts. It appears that the parties to the Avgas contracts understood that Avgas was only one of many products made by large refineries such as these. In addition, it appears to have been anticipated by both parties that these refineries would continue to make, and to sell into the domestic economy, for their own account, the product mix that did not consist of Avgas or other war products. Therefore, in my opinion, it would be inequitable to simply attribute to the government the waste streams from every product made for sale to any buyer during WWII. [35]

In light of the Court's finding that the government was not an operator of the refinery, and thereby had "lesser fault"[36] in the generation of releases into the environment from refinery operations, it would seem reasonable to consider whether the 50% share for Avgas and 40% share for "other war products" that I recommended in my August 10, 2012 report should be reduced. In my opinion, while the "facts on the ground" relating to the parties' respective roles in the contracting arrangements and the regulatory environment have not changed, the finding that the government was not a refinery operator would make a difference in comparing the government's general involvement in the wartime economy with Exxon's involvement as both an owner and sole operator of the refinery if the Court deems it appropriate to take into account the parties' status as an "operator" under CERCLA. For the same reason I opined that it would be reasonable to increase the government's share for impacts of government-owned plants based on the Court's finding that the government was also an operator of those plants (See Section IV.A, above), I believe it would be reasonable to reduce the government's percentage for refinery operations given the Court's finding that the government was not an operator of the refineries. However, given the subjective nature of such a determination and mindful that it is within the province of the Court, I do not offer an alternative percentage. If I retain the 50% share for Avgas and 40% share for "other war products" in my allocation calculations, along with other modifications, it results in a calculated share in excess of 2%, and would cause me to

[34] Since Mr. White's inter-class allocation is based explicitly on an assumption that the United States was an operator of the refinery during these two periods, I believe it is not consistent with the Court's opinion. In addition, Mr. White assigned 75% of the refinery operator share allocation to the United States and only 25% of the refinery operator share allocation to Exxon without providing a sound basis for that allocation. Since he allocated 20% to the facility owner (in this case, Exxon), and 80% to the operators (Exxon and, in his analysis, the U.S.), the resulting allocation to the U.S. is 60% (75% x 80%). This rationale also appears to be inconsistent with the Court's SJ Opinion.

[35] An April 4, 1944 report, apparently prepared for purposes of negotiations between Exxon and the government over renegotiable contracts, indicates that Exxon designated only 28% of its sales and services as renegotiable government contract sales. Humble Oil & Refining Company, Houston Texas Report at p 13 (Bates No. not yet assigned). As noted, in my prior reports, most of the refinery output consisted of products that Exxon sold into the civilian economy before, during and after WW II and Exxon continued to make profits on the sale of these products. In addition, it appears that most of the products designated by Exxon as "other war products" were sold based on competitive bidding subject to arms-length contracts.

[36] SJ Opinion at page 48, footnote 24.

alter my opinion slightly (to recommend that the government share at Baytown not exceed 3%). If those shares are reduced, for example, to 25% for Avgas and 20% for "other war products" it would produce a calculated share less than 2% and it would not cause me to alter my overall opinion. In order to present the most conservative case under the present circumstances, the calculations presented in Attachments 2 and 3 assume a 50% share for Avgas and 40% share for "other war products" as set forth in my August 10, 2012 report.

The result of a calculation using this percentage and the percentage of crude throughput attributed to Avgas (as adjusted for use of imports)[37] and other war products would be (50% x 7% for Avgas) + (40% x 22% for other war products) = 12.30% at Baytown and (50% x 9.5% for Avgas) + (40% x 25% for other war products) = 14.75%. at Baton Rouge. Whatever response cost impact is calculated for WW II refinery operations would then be multiplied by these percentages to derive the government share for the refinery.[38]

3. **Refinery Operations During WW II – Incremental Increase in Crude Throughput**

Another way of looking at the specific response cost impact of the 1942-1945 World War II period for purposes of developing an allocation is to examine the extent to which refinery crude throughput, and resultant contamination increased during this period as a result of government incentives to maximize Avgas output. It should be kept in mind that, despite the incentives to produce as much Avgas as possible, the refineries were expected to continue to operate normally and continue to produce the mix of products that had been produced prior to the war. In addition, the largest portion of the overall waste load into refinery waste systems is generated by the distillation and further processing of the incoming crude stream. Available data suggest that the increase in crude throughput averaged over the 1942-1945 period was only about 8-9% greater than the crude throughput in 1941, before the wartime period commenced.[39]

To the extent that increases in crude throughput can serve as a parameter to estimate incremental releases into the environment, the incremental impact of WW II operations (taking

[37] As discussed in my August 10, 2012 report and in the August 10, 2012 Report of Dr. Kittrell, the fact that 50% of the products used for producing Avgas were imported for blending and not produced at the refineries by processing crude, reduced the percentage of crude throughput attributed to Avgas production by half. Low August 10, 2012 Report at pp. 26-27; Kittrell August 10, 2012 Report.

[38] For example, for the response costs associated with the separators at Baytown, I have calculated that the 4-year WW II period contributed approximately 6% of the response cost impact for the remediation of these units. This 6% would be multiplied by 12.30% (= 0.74%) to calculate a government share related to refinery operations.

[39] See November 16, 2012 Rebuttal Expert Rebuttal Report of Dr. James Kittrell, p. 22. Note that this incremental impact is conservatively high because the 8-9% figure does not take into account that pre-war refinery production had been increasing on a definable trend and would have been anticipated to continue to increase along the same trend line if there had been no war. Thus, the true impact of the war would be the difference between the actual increase and the increase that would have occurred following the pre-war trend. Dr. Kittrell noted that the pre-war trend line would have predicted an increases of 8-9%, whether or not there was a priority placed on Avgas production. Kittrell Report at p. 23.

into account crude throughput needed to produce Avgas, and other war products) would then approximate 8-9%. To this incremental impact (which also takes into account any increased crude processing to produce products for the government-owned plants) one could add the waste load impact of waste streams from the Plancors that were processed at the refineries, which are approximately 4% at Baytown and are largely unquantified, but likely minor at Baton Rouge. This analysis produces WW II response cost impacts of approximately 8-9% on the low and up to about 13-14% on the high end. These percentages compare reasonably well with the percentages that result from calculations using the assumptions in my allocation framework, as discussed in Section V.B.2, above.

4. Refinery Operations During the Korean War

Finally, by the time of the Korean War, two of the government-owned plants (Plancor 1909 – the Hydrocodimer Plant – and the Baytown Ordnance Works) at Baytown were owned and operated by Exxon and the government had no involvement in these plants. With the sale of the Hydrocodimer Plant to Exxon, the government no longer had ownership of any plants that operated within the boundaries of the Baytown refinery or had any relationship to production of Avgas. At Baton Rouge, only two of the six government-owned plants remained in operation during the Korean War. The relatively negligible output of Avgas (1% of crude throughput) at both refineries during this period does not suggest meaningful involvement or influence by the government in Exxon's production of Avgas and, in my opinion, does not warrant imposition of a share to the government related to this output.

With respect to Rubber Reserve plants that the government continued to own at Baytown and Baton Rouge through 1955, as noted above in Section III, to the extent that one of the waste streams from the government-owned butadiene plant at Baytown continued to be processed in the refinery waste processing system, the impact of that waste stream on the response costs at issue is taken into account by estimating the response cost impact of that particular waste stream during 1944-1955. Any minor impacts from other plants are also taken into account (See discussion, above, in Section IV).

1. EXXON'S USE OF A SINGLE ALLOCATION FOR ALL OF EXXON'S CLAIMED RESPONSE COSTS AT THE REFINERIES AND INCORPORATION OF WASTE REDUCTION MULTIPLIERS TO INCREASE THE SHARE FOR THE PERIOD OF GOVERNMENT INVOLVEMENT

A. Overview

This section addresses statements made by Mr. White and other Exxon experts -- in particular, the recently submitted December 16, 2016 expert report of Gregory Kipp -- concerning the appropriate methodology for developing an allocation for costs claimed by Exxon for the different units and groundwater areas at the refineries, as well as the waste reduction multipliers incorporated in Mr. White's analysis. At each refinery, Exxon is claiming costs for

multiple cost components – either solid waste management units or areas of groundwater contamination. There are two important points to note at the outset:

1. As discussed above, all of these cost components are within the two refineries and have been impacted primarily by refinery operations.[40] During the period of U.S. ownership (1942- 1955), the government-owned plants had, at most, a minor impact on any contamination for which Exxon is claiming costs, in comparison to the 80-90 years of refinery operations and the more than 50 years of Exxon ownership and operation of the chemical plants after they were acquired from the government.

2. While the cost components may have been within a single, very large facility, each of them was used and/or impacted in different ways over different time periods by different activities. Each one of these units or groundwater contamination areas can be considered separately for allocation purposes. They were each investigated separately, each was impacted by different types of contamination, and the remediation plan is different for each one. Because the contamination present in these different units and areas are, in most cases, the result of different types of operations and contaminant release mechanisms, an examination of these facts should be conducted for each one for allocation purposes. As discussed below, the biggest flaw in Exxon's experts' opinions is their failure to conduct such an examination.

Although these various areas may be contained within the refinery and generally have been impacted by operations of the refineries over their almost 100 year operating history, it is common, in my experience, for an allocation analysis to include an explanation of the nature of the remedial actions and the history of use of each of the units or groundwater contamination areas for which costs are being claimed. Mr. White's description of his methodology does not include such an explanation. Instead, as I have explained in my prior reports and declaration, Exxon's allocation approach at both refineries relies on a single series of unsupported assumptions pertaining primarily to the refinery wastewater treatment systems, which are then applied similarly to each solid waste management unit or area of groundwater contamination regardless of their use or what impacted them or the time period over which they were impacted. I do not regard this approach as soundly based.

B. Mr. White's Declaration

Mr. White's answer to the above criticism is as follows:

[40] The costs denoted as Baytown Ordnance Works are for investigation and remediation of a plume of groundwater contamination that straddles the boundary between the refinery and the former Baytown Ordnance Works (which is now part of the Exxon Chemical Plant complex). According to an analysis conducted by Exxon to address how to share the cleanup costs for addressing this plume between the Chemical Plant and the Refinery, Exxon estimated that about 42% of the contaminants in the groundwater plume are from the operations in the area of the former Ordnance Works (and therefore should be allocated to the Chemical Plant) and 58% of the contaminants in the plume are from operations in the Refinery. BC Groundwater Tank farm 3000 Remediation Update, BTRF/BTCP Allocation Update, 6/20/95. BAYTECH-00047598

> *Yet the fact remains, each site is an oil refining operation, and the various areas currently being remediated are all - each of them - addressing the contaminants typical of these types of operations. The process by which releases to the environment occur - as part of the refining and waste capture/treatment process - are fairly consistent and homogenous across each of the respective sites. In addition, wastes have indeed been commingled throughout the years at both sites, and that is an important factor that must be taken into account in developing an equitable allocation. Were it the case that some particular cost element was being "driven" by a different set of facts (i.e., time, constituents, process, etc.) I would consider those in my analysis –and, where applicable, have done so - but the general criticism that because I find many of these elements consistent similar, and therefore address them as a single process, simply derives from the fact that these areas are, in fact, the result of a similar process and timeframe.*
>
> *Mr. Low's criticism implies an ability to distinguish the wastes and their sources that does not exist. These costs are not driven by a series of distinguishable events that might somehow be divided conveniently based upon discrete historical events. Rather, these are costs driven by oil refining releases from plants that were oil refineries for decades. No such convenient divisibility exists, and the approach taken here is reasonable given the historical nature of the sites and their operations.*

White January 21, 2014 Declaration at pp. 3, 4.

I respectfully disagree. In fact, the costs for these different cost components are driven by different sets of facts, events, and timeframes. Groundwater contamination caused by spills, accidents, and leaking tanks or pipelines over dozens of years is not the same as soil contamination resulting from disposal into an impoundment over a limited time period. By treating all cost components the same, Mr. White ignores these differences.

An example of Mr. White's failure to account for important factual and chronological differences is in his allocation for the Old Silt Pond and Rice Paddy Landfarm at Baton Rouge. As established both by documentary and aerial photographic evidence, both of these units were not used as waste impoundments until after WW II, yet Mr. White allocates the U.S. a share for the entire WW II period as though they were a routine part of the production process during a time when they were not operating. More importantly, both of these units were converted in the 1970s to be major waste impoundments, with structures to contain those wastes built on top of or in place of the older units, and into which significant volumes of hazardous refinery wastes were discharged through the late 1980s.

The remedial plans prepared by Exxon's contractors readily demonstrate that the remedial efforts for these units were made necessary and designed primarily to address the wastes deposited in these units in the 1970s and 1980s (although contamination attributed to the use of these earlier use of these impoundments was also to be addressed by the cleanup plans, if necessary) . Yet, Mr. White applies his most extreme waste reduction multiplier of 0.66% during the 1970s and 1980s, at the very time these two units were being used most extensively by Exxon as waste impoundments, and when virtually all of the waste that would later have to be addressed was deposited in the overlying units. In other words, Mr. White counts every barrel of

oil produced during WW II as having over 100 times the impact of a barrel of oil produced in 1980, when the units were used extensively for disposal of refinery wastes. The net result, which artificially depreciates the major waste contributions to these units in the 1970s and 1980s, is decidedly contrary to any reasonable notions of equity. The waste-reduction multipliers relied on by Mr. White have no relevance to the contamination being remedied in these units or to the associated costs, which make up close to 70% of Exxon's the past cost claim at Baton Rouge.

Mr. White goes on to say:

> *Thus, the crux of our disagreement is over the documentary evidence that demonstrate quantifiable improvements to waste processing, and whether they are relevant and reliable. I have opted to examine and apply them in what in my opinion are appropriate ways; Mr. Low has chosen to ignore them.*

White January 21, 2014 Declaration at p. 5

To this last statement, I can respectfully respond that the examination which Mr. White claims to have undertaken, for example, with respect to Baytown is very limited and consists of taking entirely out of context one sentence from a 1964 report attached to a permit application (the "Pre-Separator Impacts multiplier" of 10% -- based on a 90% reduction) and one table in a 1954 journal article (the "Production-Related Waste Efficiency" multiplier of 30% based on a purported 70% reduction in "separator sludge") and then simply multiplying these two factors together (to produce a combined 3% multiplier amounting to a 97% reduction in waste per barrel of crude in each year after 1959; periods exclusive to Exxon) and "applying" them to all units for which costs are claimed. Mr. White's method of applying the results of his limited examination eliminates virtually the entire impact of any waste load on all units at the refinery after 1959, during a period when the refinery's production ramped up rapidly, ultimately reaching figures that were at least three to four times the WW II crude throughput. Neither Mr. White nor any other Exxon expert can point to any data that show that what Exxon's own documents refer to as the prevention of evaporative losses of up to 90% afforded by the pre-separators had a response cost impact equivalent to 90% per barrel of crude oil processed on any of the claimed units at Baytown, much less on units and GW plumes not shown to be associated with the waste flows he evaluates. This is similarly true with respect to the 70% sludge reduction factor – and for both factors it is especially true with respect to groundwater contamination costs, which have made up the bulk of Exxon's claimed costs at Baytown.[41]

With respect to Baton Rouge, Mr. White relies on what he denotes as "The 1940s Program" multiplier -- 39% based on a purported reduction of 61% in the amount of slop oil generated. He also relies on what he denotes as "The 1960s Program" multiplier of 2% based on an assumption that a 98% reduction in oil content of water was achieved by 1972. But, for

[41] I note that Exxon has recently, without explanation, moved a large portion of what were previously designated as "Groundwater Remediation Costs" to the category of costs designated as "Facility Operations Area (FOA) Costs." I have not had an opportunity to examine the reasons for this, but I have assumed the FOA costs are associated with the process Exxon is undertaking to demonstrate to Texas regulatory authorities, among other things, that groundwater is not escaping from the refinery to off-site areas. I reserve my right to amend my allocation if and when Exxon provides any further explanation.

example, as noted above with respect to Baton Rouge, Mr. White has not provided an explanation about how the reductions in slop oil or the reduction of oil in waste effluent could have conceivably impacted costs for the Old Silt Pond or Rice Paddy Landfill, which make up the majority of costs claimed by Exxon.

Mr. White refers to waste-reduction percentage multipliers as "reasonable proxies for assessing the environmental performance of the refineries and should be used in these cases to assess waste improvements at the sites." On the contrary, what I believe we have here is a series of unsupported extrapolations that are substantially counter-factual to begin with, and which tend to produce an allocation that I believe an objective observer would find to be decidedly inequitable for the reasons stated. I have discussed my criticism of Mr. White's use of these adjustment factors at length in my November 16, 2012 report and my January 25, 2015 declaration, and I stand by my critique.

C. Incorporating Waste Reductions

Nor have I, as Mr. White asserts, ignored the potential that actions taken by Exxon after 1945 may have reduced the response cost impact of each barrel of crude oil processed in succeeding years. By treating the response cost impact on the claimed units of each year equally in what is essentially a "time of use" method set against a large increase in production , my allocation framework has a built-in reduction factor applicable to the response cost impact per barrel of oil for each year after 1945. Thus, despite crude throughput increases that exceed 350% at Baytown and reach almost 400% at Baton Rouge, the response cost impact on an annual basis remains the same. A comparison of my analysis with Mr. White's (see the table below) shows that I have built-in response waste reduction factors of up to 72% at Baytown and 64% at Baton Rouge measured on a per barrel of oil basis, figures that are hardly insubstantial. Mr. White assumes waste reductions of up to 97.55% per barrel of oil at Baytown and 99.44% at Baton Rouge, and applies those figures beginning very soon after the period of government involvement and refinery wide in each case. Thus, my framework has built-in response cost impact/barrel of oil multipliers of up to 28% at Baytown[42] (compared to Mr. White's 2.55% multiplier) and up to 36% (compared to Mr. White's 0.66% multiplier) at Baton Rouge. Although Exxon has not demonstrated that there has been any reduced impact on specific response costs from any of its refinery improvements, and certainly has not demonstrated any quantifiable impacts, it is not unreasonable to recognize the possibility of such impacts on a per barrel basis, which the built-in reduction multipliers in my analysis reasonably incorporates. Mr. White's figures, in my opinion, result in unsupportable reductions that have the effect of substantially reducing, and for some years nearly eliminating, Exxon's responsibility for wastes for which the Company is clearly responsible.

The tables below show the increase in crude throughput and then compares my implicit reductions with Mr. White's figures at five year intervals – depicting, for example, Mr. White's assumption that every refinery operation at Baytown after 1959 produced 3% of the waste per barrel when compared to his 1945 base year.

[42] For costs associated with the Outfall Canals at Baytown, I incorporated a further 50% reduction multiplier, making the maximum Response Cost Impact Multipliers for Each Barrel of Crude Oil Throughput equal 14.7%.

BAYTOWN

Year	Crude Throughput Capacity	% Increase from 1945 Crude Throughput	Response Cost Impact Multipliers for Each Barrel of Crude Oil Throughput	
			Low	White
1945	65,700,000		100.00%	100.00%
1950	94,900,000	144%	69.23%	71.00%
1955	111,325,000	169%	59.02%	13.60%
1960	106,689,500	162%	61.58%	3.00%
1965	100,375,000	153%	65.45%	3.00%
1970	125,925,000	192%	52.17%	3.00%
1975	146,000,000	222%	45.00%	3.00%
1980	233,600,000	356%	**28.13%**	**2.55%**

BATON ROUGE

Year	Crude Throughput Capacity	% Increase from 1945 Crude Throughput	Response Cost Impact Multipliers of Each Barrel of crude Oil Throughput	
			Low	White
1945	47,450,000		100.00%	100.00%
1950	89,425,000	188%	73.47%	39.00%
1955	119,209,000	251%	55.11%	39.00%
1960	133,225,000	281%	49.32%	21.45%
1965	132,130,000	278%	49.72%	9.75%
1970	158,410,000	334%	41.47%	6.63%
1975	162,425,000	342%	40.45%	0.78%
1980	182,500,000	385%	**36.00%**	**0.66%**

D. Mr. Kipp's Report

Although Exxon has argued for the use of these waste reduction multipliers for an extended period, even in the face of seemingly compelling arguments to the contrary and without

much apparent effort to further support them, there now appears to be a belated attempt to do so in the form of a recently offered December 16, 2016 expert report of Gregory Kipp ("Kipp Report"). Mr. Kipp claims that Mr. White's reduction multipliers are reasonable and have a basis in "scientific logic."[43] Having read that report and examined Mr. Kipp's arguments, I respectfully disagree. Mr. Kipp's opinions appear to be based on the selection of carefully selected data – mostly from the 1950s and 1960s -- as a basis for establishing impacts on overall "environmental conditions" at the refineries, without undertaking any credible analysis of whether the data actually bear on the actual cost components that are the subject of Exxon's past and near future cost claims.

1. Baytown

Mr. Kipp asserts that Mr. White's Pre-Separator Impacts multiplier" of 10% and his "Production-Related Waste Efficiency" multiplier of 30% for his Baytown analysis are valid as applied to Exxon's claimed past costs, supporting, again, a 97% reduction in waste per barrel, and more than negating large increases in production. Mr. Kipp asserts that Mr. White uses slop oil reductions and effluent data as benchmarks for his efficiency multipliers at both refineries.[44] This is incorrect for Baytown. As noted above, Mr. White's Baytown multipliers are based on the addition of pre-separators to reduce the amount of oil that evaporated and the purported reduction in separator sludge into Separator 10, and not on any reductions in slop oil or improvements in effluent discharged from the refinery.

Mr. Kipp appears to focus on certain data points that he believes justifies White's waste efficiency multipliers. For Baytown, Mr. Kipp cites a 1952 "Humble Way" Publication for the proposition that Baytown reduced oil losses from 1,869 barrels per day to 791 barrels per day, a 59% reduction.[45] This calculates to a reduction of 397,720 barrels per year, all of which Mr. Kipp appears to believe would impact relevant "environmental conditions." The publication notes that some unspecified quantity of reduction was achieved by adding cathodic protection, which reduces leaks in pipelines. What Mr. Kipp fails to mention is that the same publication he cites states that 100,000 barrels per year (or over 25% of this purported reduction) has been saved by eliminating evaporative losses at the main separator – so this is not oil that would have impacted soil, groundwater or any waste impoundments at the refinery.

Mr. Kipp also fails to note that the same publication he cites states that evaporative losses from oil storage (from "tank breathing losses") and tank filling ("tank pumping losses") can waste large quantities of oil and that much of the reductions in oil losses cited in the article were achieved by reducing these evaporative losses by tying the tanks to vapor recovery systems (which turn vapor back into liquid) or by painting the tops of tanks white to reduce

[43] Kipp Report at p. 24.

[44] Kipp Report at p.33.

[45] Id. at 4, 5.

evaporation.[46] In this instance, as well, collecting oils that would otherwise have evaporated does not remove them from pipelines and tanks or result in the reduction of contamination of soils or groundwater (though it might add to the amount of oils that conceivably could be released from spillage, accidents and leaks).

Mr. Kipp notes that cathodic protection was introduced at Baytown and he asserts that "the Baytown facility reported a 93% reduction in corrosion leaks throughout the facility during the period 1948-1951"[47] due to use of cathodic protection. Mr. Kipp does not provide a citation for this data point, so I am not able to verify it. He also does not indicate what the significance of this data point is. There are, however, other sources in the record that address the issue. The 1952 Minutes Baytown Refinery's Refinery Loss Committee notes that corrosion leaks were reduced, but it also notes that during the same period, in areas where cathodic protection was added, there was an almost 100% increase in total mechanical leaks from 1946 to 1951– a report that would tend to coincide with the notion that such leaks would increase with refinery size and complexity (there being more pipes, manifolds, and other sources of potential leaks). The reported number of leaks (not to be confused with the quantity of the oil released collectively from those leaks) decreased by about 31%.[48]

Mr. Kipp sums up his discussion of oil losses by saying that reductions in "minor leaks and losses of oil occurring daily in thousands of places at each facility, and oil releases from corrosion leaks….had been a major source of pollution at these facilities causing historical contamination that was a significant cost driver of the cleanup work at these sites."[49] This statement, implying that such leaks and losses of oil no longer were occurring or were occurring a substantially lesser rate in years after 1950 or so, is likewise without evident support. Further, Mr. Kipp again fails to include any discussion of the response costs associated with the cleanup work at the two refineries or any corollary analysis of the extent to which any source was a "significant cost driver" at the refineries.

Mr. Kipp next turns to the purported 70% reduction in separator sludge between 1947 and 1957. He then, without any further explanation, turns this single data point into a 70%

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[46] The Humble Way January-February 1952, Stop that Leak, BAYC-00013898 at 13900, 13901. Exxon repeatedly noted that evaporation from tankage continues to be the largest source of oil loss and that evaporative losses from the separators was an important source. Twenty-Sixth General Meeting of the Central Loss Committee April 16-18, 1956. MIS-00028151 at 28153. Twenty-Seventh General Meeting of the Central Loss Committee April 15-17, 1957. MIS-00028151 at 28153; Twenty-Eighth General Meeting of the Central Loss Committee April 30-May 2, 1958. MIS-00028159 at 28186.

[47] Kipp Report at p. 7.

[48] Refinery Loss Committee, Minutes of 22nd General Meeting, March 31-April 4, 1952. MIS-00031624 at 31654. The report notes that "The frequency of mechanical leaks was steady throughout 1951 and there is some reason to believe that it will increase as the average age of neoprene gaskets and leak clamps increases." Id. at 31647.

[49] Kipp Report at p. 9.

reduction of what he terms "sludge and slop."[50] There are a couple of points to be made about this data point, which, as noted above, constitutes the sole basis of one of Mr. White's waste efficiency multipliers. First of all the only basis for this data point is a table in a 1958 Oil and Gas Journal article by S.O. Brady, an Exxon employee, and the article refers to a reduction of 10,000 pounds per day of separator sediment in 1947 to 4,000 pounds per day of separator sediment in 1957. It is not clear that Mr. Brady is referring to separator sludge and whether this reduction carried through to later years. Other data points available in the record include:

- a table in a 1967 Exxon Report indicating that "Sediment from the bottom of the refinery's oil-water separator averages 350 tons/week," which equates to 100,000 pounds per day;[51]

- a 1971 Exxon memo which indicates that 14,000 cubic yards accumulate annually in Separator 3M, which equates to approximately 77,000 pounds per day;[52]

- a 1972 Exxon Memorandum -- Solid and Liquid Waste Management, indicating 25,000 cubic yards of separator sludge per year, which equates to approximately 138,000 pounds per day;[53]

- a 1976 Exxon compilation of sludges at the Baytown Refinery indicates a total of 43,500 tons of "Separator (or Impoundment Pond) Sludge 30 wt% d.s.," which equates to 238,356 pounds per day;[54]

- In 1986, invoices for the closure of the northern half of Separator 3M indicate that 28,490 cubic yards of sludge was removed from the unit during the closure,[55] despite the fact that, according to Exxon's closure plan, settled sludge was dredged from the pond once or twice per year.[56]

These other data points appear to suggest that the 70% reduction figure relied on by Mr. White and which Mr. Kipp supports, does not carry through to later years as production at the refinery increased substantially. Mr. Kipp does not cite any data that might indicate what the relationship is between separator sediment, as used in the 1958 Brady article and separator

[50] Id.

[51] NACCMIS-00035206 at 35210.

[52] Internal Exxon Memorandum dated August 9, 1971 Re: Study of Bypassing Pit 3, BAYC-00013788.

[53] April 17 1972 Exxon Memorandum -- Solid and Liquid Waste Management, MIS-00028346 at 28347.

[54] NACCMIS-00046225.

[55] BAYTECH-00126137.

[56] January 20, 1985 Closure Plan for Spill Basin 1 [formerly Separator 10], Separators 3A and 3M and the South Landfarm at the Baytown Facility. ERM-Southwest, Inc. BAYTECH-00095523, at page 4-8.

sludge or how the accumulation of separator sludge actually changed over time subsequent to Brady' article. From the data above, it appears that large quantities of separator sludge were generated in Separator 10 and accumulated in Separator 3M at Baytown in years after 1957. The primary point here is that Mr. Kipp's analysis, relying as it does on a single data point and ignoring all other evidence even when it is available, simply follows Mr. White's apparent result-oriented analysis. In my opinion, Mr Kipp's report does not add anything meaningful to the discussion, and does not demonstrate that Mr. White's waste efficiency factor and its application to all of Exxon's claimed units is credible or reliable.

Mr. Kipp then argues that the oil in the aqueous fraction of the wastewater was the cause of groundwater contamination beneath Separator 10 and turns to the 90% reduction in oil to Separator 10 achieved by the installation of three pre-separators.[57] But the new report fails to explain the relevance of this observation, even if we assume it to be true. As discussed in more detail below, the 90% reduction said to be achieved was also specifically said to be light fraction material that had previously evaporated – so the same hydrocarbons would not have been or remained in the aqueous phase that may or may not have impacted the soils beneath Separator 3M. Further, although Mr. White applies his reduction factors refinery-wide, Mr. Kipp's supporting work fails to note that the groundwater plumes being addressed by Exxon are not in proximity to Separator 10, nor are they in any process areas.

Whatever may be made of the foregoing, there remains a serious objection to Mr. White's method that derives from the fact that the accumulation of separator sludge is entirely irrelevant to the evaluation of very large portions of the costs claimed at Baytown. The largest amount of costs presented by Exxon for Baytown is for interim corrective actions associated with groundwater contamination which, as indicated by Exxon's own documents, consist of thirteen separate plumes (broken out by four Plume Areas and 13 sub-areas) as designated by Exxon:[58]

- Tankfarm east of Docks 2 and 4 (Plume Area 1-- consisting of sub-areas 1-1 thru 1-5);
- Area just north and east of Dock 1 (Plume Area 2 – consisting of sub-area 2-1);
- Area midway between Dock 1 and Wastewater Oxidation Unit (Plume Area 3 -- consisting of sub-areas 3-1 thru 3-3); and
- Tankfarm north of Bayway Drive and west of San Jacinto Avenue (Plume Area 4 – consisting of sub-areas 4-1 thru 4-4).

Mr. Kipp does not mention these plume areas in his report and does not indicate how any of the improvements he discusses in his report impacted these plumes, which, as noted by an Exxon environmental contractor, are not in areas where crude was being processed. According to the Exxon contractor's 1995 report, all four plume areas:

> *"are located in 'offsite' areas as opposed to being located within process unit boundaries. 'Offsite' refers to land used for the storage and transfer of petroleum feedstocks, intermediates, and products. Therefore the potential sources of hydrocarbon*

[57] Kipp Report at p. 14, 15.

[58] August 18 1995 Radian Past Remedial Activities Report, BAYTECH-00013540 at 13544.

that could have contributed to these plume sites are suspected to be either leaks from underground HC pipelines or leaks from the bottom of HC storage tanks."[59]

The same contractor noted that "[N]one of the four plumes are [SIC]suspected of having been caused by activity conducted within any Solid Waste Management."[60]

Compounding this basic problem, Mr. Kipp does not discuss the contaminants being addressed in these various individual plumes. The most comprehensive snapshot of the plume characterization data available to date is contained in Table 2-1 of Exxon's Groundwater Quality Assessment Plan as indicated in the following table: [61]

	Product		
Plume Sub-Area	**Based on API Gravity Analysis**	**Based on Sample Point Distillation/Compositional Analysis**	Additional Information from August 18 1995 Radian Past Remedial Activities Report, BAYTECH-00013540 at 13563-66
1-1	diesel	MW-27 alkylation bottoms; HRW-16 similar to diesel fuel	
1-2	lube oils	NA	
1-3	diesel	MW-141 - slop oil, cataytic naptha; MW-167 - gasoline, kerosine, lube oil	
MW-111/112	gasoline	NA	
1-4	diesel	MW-118 - napthenic crude, slop oil; OW-1 - gasoline, kerosene, lube oil; OW-3 - norpar 13, slop oil; MW-12 - diesel fuel	
1-5	diesel or lube oils	MW-142 - napthenic crude, slop oil; MW-117 - heating oil, diesel fuel	

[59] Id.

[60] August 18 1995 Radian Past Remedial Activities Report, BAYTECH-00013540 at 13549. I am aware that Peter Gagnon, Exxon's expert, has testified that since the date of this report, additional data indicate that one Solid Waste Management Unit (SWMU 69) may have contributed to contamination in one of the thirteen sub-areas.

[61] Radian Corporation September 1995 Groundwater Quality Assessment Plan, Volume 1 of 2, BAYTECH-00008819, pages 2-1 to 2-6

2-1	diesel or lube oils	MW-129 - heating oil, diesel fuel; MW-30 - similar to diesel fuel	
3-1	diesel or lube oils	MW-133 - No. 5 fuel oil, reduced crude; HRW-45 - reduced crude	
3-2	lube oils	HRW-50 - process oil, sievate; HRW-53- reduced crude or heavy residue after naptha removed	
3-3	diesel or lube oils	NA	
4-1	NA	General - mixed aromatics; RW-749 - reformate	Believed to be concentrated aromatic bottoms from the Aromatic Distillation Unit (ADU), which would appear to be very similar to reformate. ADU bottoms stored in Tank 749 through 1976/1977 Change of Service
4-2	gasoline	General - motor gasoline; RW-346 - catalytic naptha; CPT-344 - heavy catalytic naptha, CPT-347- heavy catalytic naptha	Believed to be Esso Golden Extra high octane gasoline last produced in the 1960s -- based in part on clear golden color
4-3	gasoline	General -- aviation gasoline; RW-336 - aviation gasoline; CPT-333 - kerosene, light alkylate, regular gasoline; CPT 337 -- Kerosene, light alkylate, regular gasoline, aviation gasoline	Notes blue color -- characteristic of blue dye added to aviation gasoline for positive identification
4-4	NA	RW-816 - heating oil, diesel fuel	Or Kerosene blendstock

As can be seen from the above table, the plumes contain various products likely stored in tanks or moved through pipelines to processing areas. Only one plume sub-area (4-3) is characterized as containing aviation gasoline (which could be from WW II or years before or after WW II). The majority of other areas are characterized as diesel, motor gasoline, lube oils and kerosene, components which are not associated with aviation gasoline or WW II Avgas components. Mr. White, Mr. Kipp, and other Exxon experts have not presented any breakdown of costs for these various plume areas, or any analyses of the extent to which any of these plume areas contain any products specifically associated with Avgas production during WW II.

Although, in my opinion, it may be reasonable to draw an inference that some releases eventually leading to groundwater at least could have occurred during the 1942-1945 period, the plume characterization data and other evidence do not suggest that any meaningful percentage of the contaminants Exxon has been remediating is from that period. The refinery underwent significant expansion[62] and spills and leaks have occurred throughout its entire operating period.

As recently as the January 1990 to June 1995 period, Exxon documented thirty one spills to surface or groundwater in the vicinity of the plume sites. The total quantity of spilled materials from these spills was estimated at over 125,000 gallons.[63] And though Exxon maintains that it had taken steps to prevent leaks, from tanks and pipelines, the report indicates that 14 incidents involved leaking pipelines or leaking tank bottoms or roof drains. The remainder was from combinations of human error, faulty equipment, overloading, or other reasons. Even during the more recent remediation of these plumes, additional leaks have been detected requiring the expansion of the groundwater remediation system. According to a consultant for Exxon, in January 1990, the system was expanded to address a newly discovered leak from an underground transfer line. The expansion included a new recovery pump and a dedicated oil/water separator and 500 gallon tank for recovered oil. According to the same consultant, in April 1990, the groundwater recovery system was expanded again to recover hydrocarbons seeping into the ground near Tank 4-1.[64] It is also noteworthy that between 1958 and 1973 tank bottoms were buried in soils within the four plume areas, providing another source of contaminant migration to groundwater.[65] All of these considerations cut against both Mr. Kipp's analysis of the very limited data he has cited, and against his argument in support of Mr. White's otherwise unsupported proposal to extrapolate from highly problematic calculations to a refinery-wide waste reduction factor that all but assumes that refinery waste at Baytown matters very little after 1959.

As for the specific basis for Mr. White's "pre-separator multiplier" (10%), it is based on a single page of an Exxon report, apparently attached to a 1964 permit application. That reference states:

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[62] As one example, in the 1970s, Exxon constructed a major expansion of the refinery, called the Baytown Fuels Expansion (BTFE) project, which added sixty miles of additional pipelines and more than 300 storage vessels – and also added a pipe still, a naphtha hydrofining unit, a powerformer, crude light end towers, kerosene and light gas oil hydrofining units, a residfiner, a hydrogen plant, sulfur recovery units and a water treatment plant. Exxon Baytown Texas, A Ninety Year Legacy, at p. 36.

[63] August 18 1995 Radian Past Remedial Activities Report, BAYTECH-00013540 at 134568 Table 1. See, also BAYTECH-00014630, at 4631 (TNRCC Executive Summary of Exxon's RCRA Permit Modification – noting "numerous spills at this facility" and listing over 150 spills in excess of 100 pounds from March 1989-May 1993), and at 4632 (listing Exxon's violations of its permit provisions).

[64] August 18, 1995 Exxon Baytown Refinery Past Remedial Activities Report. BAYTECH-00013540, at 13558.

[65] Id. at p. 13551.

> The pre-separators remove the oil that can be easily separated: they are covered to prevent loss of low boiling hydrocarbons into the atmosphere. Approximately 90 percent of the oil in the waste water is removed at the pre-separators. **This materially reduces the oil lost by evaporations on the master separator**.[66] (Emphasis added)

The import of this is that oil, which previously was being lost to evaporation in the master separator, was now being recovered at the covered pre-separators. But because the oil recovered in the pre-separators was the easily separated oil and would have otherwise evaporated, it is unlikely that it would have been in tanks or pipelines in the dock areas or tank farms where the four plume areas are located.[67] Notably, Mr. Kipp quotes the above passage, but does not discuss the fact that the recovered oil was the type normally lost to evaporation, not lost to settling at the bottom of Separator 10 or to releases into soil and groundwater. As late as 1970, an Exxon internal memorandum noted:

> Our program of installing unit separators and pre-separators has reduced evaporation losses on the main separator by removing oil from the system before it gets to the main separator.[68]

Mr. Kipp also attempts to correlate improvements in effluent quality with reduction in response cost impact for the units and groundwater areas claimed by Exxon – referring to it as a "causal relationship between effluent performance and site pollution"[69] and asserting that "the percentage reductions in wastewater contaminants would casually [SIC] relate to and therefore serve as an acceptable surrogate for determining, the percentage reductions in the contaminant contributions to various waste units, and the soil and groundwater contamination throughout the facility during post-war period."[70] Mr. Kipp refers to "historical data" which consistently showed 94% to 98.5% reduction in oil concentrations.

Documents in the record do indicate that improvements were made in the quality of the effluent discharges at the refinery.[71] Although these improvements in effluent discharges may be

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[66] BAYC-00013637 at 13644.

[67] In his deposition, Peter Gagnon, Exxon's expert, conceded that if there was evaporation or volatization of hydrocarbons, then they would not have contributed to contamination in soil or groundwater. Gagnon deposition at p. 266, lines 17-20; p. 271, lines 13-16.

[68] January 15, 1970 Exxon memorandum – Baytown Refinery Air and Water Conservation Program, BAYC-00000315 at 319.

[69] Kipp Report at p. 20.

[70] Id. at 22.

[71] One Exxon document suggests that prior to the beginning of the effluent improvement program, oil and grease concentrations were 181 parts per million (ppm). Refinery Loss Committee, Minutes of 22nd General Meeting, March 31-April 4, 1952. MIS-00031624 at 31639. Mr. Kipp starts his analysis by citing an article indicating an oil and grease concentration of 700 ppm. But it is not clear what the actual source of this data point in the cited article is. Kipp Report at 23. The Refinery Loss Committee data

related to future costs associated with contamination of water bodies in proximity to the associated refinery outfalls**,** Exxon has not demonstrated that they correlate with the units for which past costs are being claimed, which are upstream of the outfalls. And, in fact, certain improvements of the sort described can tend to result in the generation of greater amounts of solids and sludge that need to be disposed or treated by refineries.[72]

Further, substantial improvements in effluent were accomplished by adding dilution water or constructing additional solids settling basins downstream of the outfall canals, changes that do not suggest reductions in initial waste loads that would have impacted separators and outfall canals, for example. One of the more significant changes made in 1950 to reduce discharge concentrations to meet evolving permit limits was the addition to the Lower Outfall Canal of 20,000 gallons per minute (calculates to 28.8 million gallons per day) of water from Black Duck Bay prior to discharge into the Houston Ship Channel in order to, according to Exxon, "dilute toxic constituents."[73] Another change around 1964 was the addition of three large aeration basins downstream of the Separators and Outfall Canals to allow further settling and treatment of waste effluent for 45 days prior to the final discharge, an addition which accounted for reduction of more than 70% in volume of pollutants in refinery discharges to the Houston Ship Channel.[74] Subsequent year changes included adding a biological treatment lagoon downstream of the Separators and Outfall Canals and prior to the settling basins.[75]

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point would seem to be more reliable. By 1964 it was 44 ppm measured against a total outfall volume that included an additional 20 million gallons per day of water from Black Duck Bay – suggesting a 50% dilution factor – and suggesting that the concentrations entering the Outfall Canals from the Separators might have been around 88 ppm. I am not aware of any data provided by Exxon on discharge concentrations for the 1970s or 1980s, but, the most recent 2011 permit for the main Refinery outfall allows an average of over 5,000 pounds of oil and grease permitted to be discharged every day, or an average of about 19 ppm on the average discharge volume of 33 million gallons per day. TPDES Permit No. WQ0000592000, Texas Commission on Environmental Quality Permit to Discharge Wastes issued January 26, 2011. All of this is just for oil and grease. The closure of main separators and wastewater canals required analysis of many other chemical constituents for which there are no historical data.

[72] "One of the consequences of decreasing the pollutants in wastewaters has been the increased generation of sludge...." An Historical Overview of Solid Waste Management in the Petroleum Industry. Discussion Paper for American Petroleum Institute. MISC-00010288 at 10305.

[73] 1964 Exxon Report accompanying issuance of water discharge permit. BAYC-00014289.

[74] September 23, 1964 Humble Memorandum Air and Water Pollution Effect of Plant and Field Installations, Baytown Refinery. BAYC-00000800, at 801. The same memorandum also notes that phenolic material "purchased waste oils" was discarded to the refinery's effluent. Id.

[75] See Use of Aerated Lagoons and Ponds in Refinery and Chemical Waste Treatment. BAYC-00000076, at 94. "During the four year period from 1962-1966, the effluent load of the refinery complex increased approximately 50 percent. ……The use of additional waste stabilization ponds was ruled out because of space limitation. …. It was decided to construct an aerated lagoon and use this facility in series with the waste stabilization ponds."

All of the changes highlighted above are downstream of the refinery units and groundwater contamination areas that are the subjects of Exxon's claim. Therefore, they would not have impacted the costs incurred by Exxon to remediate the Separators and Outfall Canals, nor would they have had any impacts on leaks, spills, accidents, and human errors associated with releases into any of the four groundwater plume areas – though they might be relevant to future costs in the ship channel itself, depending upon what contaminants, if any, are found and addressed. I therefore must disagree with Mr. Kipp's suggestion that reductions in oil concentrations in effluent correlate in any meaningful way with reductions in releases of oil constituents to groundwater or contamination in separators and other impoundments.

Beyond this fundamental objection is considerable evidence that, even if improvements in effluent quality could be correlated with reductions in contamination of soils beneath waste impoundments or reductions in releases of contaminants into groundwater, effluent quality improvements claimed in reports like those Mr. Kipp cites were not always as great as Exxon purported them to be. For example, as noted in a 1967 Exxon memorandum:

> *To a degree, Baytown Refinery's public image has outpaced its performance. In the field of water pollution control for example, publicity indicates that the refinery does an outstanding job. Very few people realize one half of the refinery's effluent is currently bypassing the lagoons and fails to meet government regulations. Storm water runoff containing appreciable quantities of oil represents a problem for which no entirely satisfactory solution exits.*[76]

A 1970 internal Exxon memorandum indicated that there are still times when it is necessary for the refinery effluent to bypass all or part of the biological oxidation (BIOX) system to avoid upsetting the biological activity.[77] The same memorandum also notes:

> *The total flow of process water, cooling water and storm water runoff must flow through the single sewer system and the main separator. For fire protection, all lateral sewers enter the main sewers through water seals. These seals are also good oil traps. After a storm, the increased velocity in the sewers due to runoff causes sufficient turbulence to wash the trapped oil into the main sewers. Flow rates due to storm runoff are often 40 times normal flow. The velocity and turbulence resulting from flows of this magnitude do not allow much of the oil to separate out in the main sewer. As a result, large quantities of oil are carried out into the Houston Ship Channel.*[78]

> According to a 1967 Exxon memorandum:

[76] July 13, 1967 Exxon Memorandum -- Recommendations for Improvement of Baytown Refinery's Pollution Control Program BAYC-00000163 at 168.

[77] January 15, 1970 Exxon memorandum – Baytown Refinery Air and Water Conservation Program, BAYC-00000315 at 316, 320-322.

[78] Id. at 320.

> *"The 2.5 M gallons/day effluent stream from the polyolefin and aromatic chemicals area (from Enjay – the Baytown Chemical Complex) has caused very severe operating difficulties at the refinery's main separator, and in the slop oil rerunning facilities. Waste polymer in the form of a relatively fine dust collects in the sewer during normal operations. Heavy rains flush the sewer systems, depositing the polymer in the oil phase on the separator. Pumping the oil from the separator becomes very difficult, as the pump screens frequently clog with polymer. Another problem encountered in processing the 2.5 M gallons/day effluent stream from Enjay is the high biochemical oxygen demand (BOD) experienced occasionally in effluent from the aromatic chemicals units. ....Materials exhibiting high biological oxygen demand aggravate a capacity limitation in the refinery's lagooning [SIC] system because of the limited oxygen pickup by natural aeration in the ponds."*[79]

Finally, even with respect to the Separators Mr. Kipp fails to even discuss the nature of the contaminants that were remediated. With respect to the remediation of contamination in underlying soils, cleanup goals for a number of chemical constituents were established to guide the amount of soils that needed to be removed. Based on Exxon's Closure Plans for these units, the soils would have had to be remediated to meet cleanup requirements for a number of contaminants besides just "oily waste," including chromium, lead, nickel, oil and grease, benzene, toluene, cresols, phenol, pyridine, and methyl ethyl ketone, among others.[80] The amount of soil remediated and consequent costs depended on how much soil contained contaminants at levels that exceeded these cleanup goals, whether by a small amount or by a large margin. Based on this, it does not appear that there is any reason to conclude that WWII and Federal involvement made much, if any, difference in the amount of contaminated soil that had to be removed from under the separators. Mr. Kipp does not mention this at all in his report and his focus just on oily waste does not address continuing sources of these additional contaminants.

2. Baton Rouge

For Mr. Kipp, as well as Mr. White, their failure to even consider the use, operation and the consequent response actions for the units for which Exxon is claiming costs is best exemplified by their treatment of the Old Silt Pond and Rice Paddy Landfarm at Baton Rouge. Costs for remediation of these two units make up the majority of the costs claimed by Exxon at Baton Rouge. In my opinion, it is noteworthy that Mr. Kipp does not even mention these units, much less explain how his "slop reduction" multiplier or "oil content in effluent reduction" multiplier impacted the response costs for these units. As noted above, both of these units for which Exxon is claiming costs were not used as waste impoundments until after WW II – and the Rice Paddy Landfarm area began being used as an impoundment well after WW II. More importantly, both of these units were converted in the 1970s to be major waste impoundments –

[79] April 1967 Internal Exxon Report NACCMIS00035125 at 35219.

[80] See, e.g., Partial Closure Plan for Separator 3M, February 17, 1984, BAYTECH 00013407, pages 3-7 to 3-9. In particular, it was noted that API separator sludge was listed as a hazardous waste because of the leachable chromium and lead content.

into which significant volumes of hazardous refinery wastes were discharged during the 1970s and through the late 1980s. If Mr. Kipp had examined these units in detail, in my opinion, he would have seen that the remediation was necessitated primarily by the use of these units in the 1970s and 1980s for disposal of large amounts of hazardous substances and he probably would have conceded that White's allocation of less than 1% of the response cost impact to these units during the period 1975-1985 had no basis in what Mr. Kipp refers to as "scientific logic."

The other main component of Exxon's claimed costs at Baton Rouge concerns The Shallow Fill Zone (SFZ) Area, an area that encompasses much of the western portion of the refinery. The corrective action program includes installation of wells for monitoring and hydrocarbon recovery along the western edge of the SFZ. This area was used for a variety of waste impoundments and structures over the years and included areas that were filled with dredged and other materials that may have contained contaminants. Exxon's expert has noted that "…complete information regarding the timeframe and nature of the hazardous and solid wastes disposed of within the batture area, including the SFZ Area, is not available…"[81]

A 1986 environmental consultant report prepared for Exxon noted that, prior to the 1950s, "this area of the refinery was periodically flooded by the Mississippi River. To prevent this periodic inundation and to allow productive use of the area, fill materials have historically been placed throughout the area to elevate the land surface." The report further states that "a significant source of fill material consisted of silt removed from river water used in the refinery for once through cooling. The river water was typically comingled with oily wastewaters and/or oily sludge in a large 'silt' impoundment in the western sector of the refinery."[82] This silt impoundment would appear to be the Old Silt Pond, discussed above, which was not placed into service until October 1945. This is consistent with aerial photographs that show that it was only after the 1942-1945 period that much of the southern portion of the SFZ apparently was filled and put to use.[83] Thus, much of the SFZ stems from Exxon's election, apparently beginning sometime in the 1950s, to use fill from areas that it knew or should have known contained contaminants from the refinery and to create units for handling wastes in the filled areas.[84] Other units placed in service after 1942-1945 also may be a source of contamination in the SFZ.

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[81] Gravel Report, p. 218.

[82] Shallow Fill Zone Hydrogeologic Investigation, ERM-Southwest, October 31, 1986. BRTECH-00002158, at 2160.

[83] Sitton Report, p.15. (Analysis of aerial photographs)

[84] That fact points to another problem with Mr. White's proposal to use his global waste reduction factors. Many treatment options that tend to improve effluent quality increase the land-side waste load, exactly as happened in this instance with the OSP. Oil Water separation and silt treatment were measures designed to improve the effluent quality from Baton Rouge – at the expense of the creation of large impoundments that were required to contain the material that was now not being discharged to the Mississippi River. Exxon has not claimed any costs at Baton Rouge relating to sediment or other contamination in the Mississippi River, so there is no cost group against which the supposed improvements in effluent quality might operate.

As with the Old Silt Pond and Rice Paddy Landfill, Mr. Kipp's report provides no information explaining the reason for Exxon's claimed expenditures, and no information regarding whether any of the fill was placed in the SFZ during the WW II period. He also does not discuss the impact on the Shallow Fill Zone of the many waste treatment units and impoundments that were constructed after the 1950s in the Shallow Fill Zone area, including units that were documented sources of contamination in 1987.[85] Units subject to Shallow Fill Zone groundwater requirements, and the dates they were placed into service, include the following:[86]

- Wet Gas Scrubber Ponds -- aeration pond and two settling ponds (1972);
- BIOX Aeration Basins (1974);
- Clarifiers (1974);
- Clean Master Separators (1974);
- Dirty Master Separator (1976);[87]
- Dirty Water Retention Basin (1976); and
- South Batture Landfill (used for disposal of sediments from the former Master Separator).

The difficulty with Mr. White's approach to date, and with Mr. Kipp's attempts to support it, is that, whether intended or not, the global waste reduction multipliers Mr. White favors produce results at Baton Rouge that are substantially detached from the facts at the refinery over time, and that tend to greatly exaggerate the impact of WWII operations and any government involvement at the refinery. The result can be shown to be decidedly inequitable on even a modest examination of those facts, and, in my opinion, there are ample reasons that should preclude the Court's reliance on Mr. White's calculations.

[85] See, e.g., a 1987 Louisiana Department of Environmental Quality Compliance Order noted that the "severe cracks in the side walls below grade oil-water separator tank…..provide an opportunity for wastes to migrate into the environment." Compliance Order, February 5, 1987, BRC-00022877, at 22878.

[86] Preliminary Report RCRA Facility Investigation Report for Exxon Company, Woodward Clyde Consultants, February 1991. BRTECH-00006452 at 6472-92.

[87] The DMS and CMS were once part of the natural drainage area, occupying a former slough named Calahan's Bayou. The area was damned around 1950 to serve as a retention area (the Master Separator) for once-through cooling water. The river water contained river silts and oils; the oils and silt were removed in a silt plant operation. In 1974, an inner dam (Cofferdam) was constructed which led to the current-day configuration of the Clean Master Separator (CMS) and the Dirty Master Separator (DMS). Preliminary Report RCRA Facility Investigation Report for Exxon Company, Woodward Clyde Consultants, February 1991. BRTECH-00006452 at 6481.

2. SUPPLEMENTAL ALLOCATION CALCULATIONS DISCUSSION

A. SWMU 60 – Mitchell Point

Since my August 10, 2012 report, Exxon has added a significant amount of costs at Baytown relative to SWMU 60, sometimes known as Mitchell Point. According to Exxon reports, SWMU 60 was used during 1930-1947 as a disposal site for dredge spoil from the Houston Ship Channel; from 1947-1973 as an earthwork, and from 1957-1973 as a landfarm and a staging area for transfer pipelines, and a disposal site for butyl rubber.[88] The soil at SWMU 60 has been reworked several times throughout history due to movement of transfer pipelines and construction activities.

According to Exxon's Response Action Plan for SWMU 60 (Mitchell Point), the area was historically used for waste management including disposal of dredge spoil from the Houston Ship Channel, a landfarm, a staging area for transfer pipelines, and a disposal site for butyl rubber.[89] Based on aerial photographs from 1930 and a hand drawn 1931 map, it is believed that the area received dredge spoil from the Houston Ship Channel. [BAYTECH-00003555]

According to the 1987 RCRA Facility Assessment (RFA)/Visual Site Inspection (VSI), the area was used as a landfarm by Exxon for treatment of approximately 8,000 cubic yards of oily sludges.[90] According to Exxon's environmental contractor, ERM, no documentation is available to confirm the amount of waste sent to the site. Aerial photographs show active waste disposal activities throughout the 1950s and continuing until 1972.

Three major underground pipeline corridors pass through the eastern part of the SWMU. Two ExxonMobil Pipeline Company (EPC) transfer facilities and one transfer facility owned by Tejas Gas Pipeline Company are located on the north side of the SWMU (and up gradient from the SWMU in terms of groundwater flow). Buried and above ground pipelines are located in the vicinity of the SWMU and are owned by MidCon, Tejas, PraxAir, TEPPCO, Chevron, EPC, Amoco, and Shell. Pipeline construction begun in 1999 related to widening and deepening of the Houston Ship Channel resulted in removal of vegetation in some areas of the SWMU.[91]

Parties other than the Baytown Refinery may have contributed contaminants of concern. The EPC benzene/nitrogen transfer facility was identified by ERM as a possible source of

[88] Revised RCRA Facility Investigation Work Plan for Twenty-Two Solid Waste Management Units, June 15, 1998. ERM. BAYTECH-00003336, at 3472. The timeframe during which butyl rubber was disposed is not indicated.

[89] BAYC-00073205.

[90] BAYC-00073623.

[91] BAYTECH-00003555.

contamination. This facility was used as a pumping and metering station from the 1940s to 1992. During installation of secondary spill containment structures in 1992 hydrocarbon impacted soil was discovered.[92]

Other than asserting that this unit area was in operation during 1942-1945, Exxon provides no other information on how the production of Avgas during WW II may have impacted this unit. Given that this unit appears to have been used primarily for disposal of dredge spoils during 1930-1947, and is also the location of a number of pipeline corridors, it is not evident that wastes from the production of avgas during World War II or any other WWII production activities would have contributed to the need to remediate it. Exxon has not indicated how production during 1942-1955 impacted any dredging activities and, therefore, how Exxon's claimed response costs were impacted by production activities during that period. In the absence of evidence that would demonstrate that operations during the period of government involvement contributed contamination to this unit, in my opinion, there is no basis to attribute any response cost impact or damages for this unit to the production of avgas. However, in the event that the Court finds that some portion of the response costs for this unit may be attributed to the period of government operations, in my opinion, a reasonable way of calculating damages would be based on a years of operation analysis, using the years 1930-1992, unless more specific evidence on impacts from any particular period is introduced.

B. Former Ordnance Works Cleanup

The costs categorized as "Former Ordnance Works Cleanup" appear to be for investigation of a groundwater contamination plume located in the vicinity of the former Baytown Ordnance Works (BOW). The BOW, which was considerably expanded after Exxon acquired it in 1946, is now a part of the Baytown Chemical Plant, which borders the Baytown Refinery. This plume area is commonly referred to in Exxon's technical documents as the Tank Farm 3000 area. For purposes of the present case, Exxon has categorized these costs as cleanup of the former Ordnance Works, and presented an analysis based on 100% of the contamination being associated with the Ordnance Works. My August 10, 2012 report also considered the source of the plume to be the Ordnance Works. However, based on my review of additional Exxon documents subsequent to my August 10, 2012 report, it is apparent that the plume actually straddles the border between the Baytown Chemical Plant and the Baytown Refinery. According to an analysis conducted by Exxon to address how to share the cleanup costs for addressing this plume between the Chemical Plant and the Refinery, Exxon estimated that about 42% of the contaminants in the groundwater plume are from the operations in the area of the Ordnance Works (and therefore should be allocated to the Chemical Plant) and 58% of the contaminants in the plume are from operations in the Refinery.[93] Thus, a proper allocation for these costs requires an examination of the response cost impact of both the Ordnance Works and the Refinery. Accordingly, I have revised my allocation calculation as follows:

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[92] Id.

[93] BC Groundwater Tank farm 3000 Remediation Update, BTRF/BTCP Allocation Update, 6/20/95. BAYC-00051445; BAYTECH-00045798.

- For 42% of the allocation, I relied on the government allocation percentage that I calculated in my August 10, 2012 Report for the BOW;

- For 58% of the allocation, I have relied on the government allocation percentage that I calculated for the refinery groundwater plumes.

With respect to the allocation percentage calculated for the Ordnance Works contribution to the plume, as noted in my August 10, 2012 report, no post-1946 production information for the Ordnance Works plant was produced by Exxon so there is no basis to compare the operations during WW II when the government owned the plant, with the operations and generation of contaminants beginning in early 1946, when Exxon owned and operated it. However, as I noted Exxon's own documents indicate that the plant was expanded and many new units were added after Exxon purchased it in 1946.[94] Exxon's own contractor's analysis of hydrocarbons in the groundwater plume,[95] which was required to be submitted to Texas regulatory authorities as a condition of a consent decree with the state, indicated that contaminants in the groundwater plume include mixed xylenes from the Paraxylene Extraction Unit (PXU), (which, according to Exxon's Annual Report, was installed in 1953,[96] and the kerosene feed and LPU product from the Linear Paraffins Unit (LPU), installed in 1964, both of which came into operation after any U.S. involvement with this facility. PCB contamination in the groundwater was traced to the LPU. In addition, the analysis also indicates that certain alkalytes found in the groundwater are from the 1970s. These considerations were factored into my August 10, 2012 allocation for the BOW groundwater plume.[97]

C. Shallow Fill Zone at Baton Rouge

The Shallow Fill Zone (SFZ) Area encompasses much of the western portion of the refinery. The corrective action program includes installation of wells for monitoring and hydrocarbon recovery along the western edge of the SFZ. This area was used for a variety of waste impoundments and structures over the years and included areas that were filled with dredged and other materials that may have contained contaminants. Exxon's expert has noted

[94] Humble 1946 Annual Report. MIS-00026521.

[95] 2/2/1993 AES Phase III Subsurface Investigation of Tank Farm 3000 and adjacent areas. Exxon Chemical Americas, Baytown Chemical Plant, BAYTECH-00027105

[96] Humble 1953 Annual Report. MIS-00008371.

[97] See Low August 10, 2012 Report at p. 23. Based on an assumption that at least 33% the plume area contamination being remediated is from units placed into operation after 1946 and, therefore, should not be the responsibility of the U.S., my allocation reduced the percentage of claimed costs by 33% and allocated the remainder based on years of operation. Since my August 10, 2012 report, I have further examined the data in the cited Exxon report and created a chart showing that Exxon's plume characterization report indicates that up to 42% of the contamination in the plume area may be related to units placed into operation after 1946. See Attachment 6. In my opinion, this analysis supports the 33% reduction I relied for my August 10, 2012 report, applied to both the refinery contribution (58% of the allocation) and Ordnance Works contribution (42% of the allocation).

that "…complete information regarding the timeframe and nature of the hazardous and solid wastes disposed of within the batture area, including the SFZ Area, is not available…"[98] In my August 10. 2012 report, I stated that "[G]iven the absence of any information that would allow for a quantitative apportionment of contaminants, or even materials, placed in this area, in my opinion, the most appropriate method of allocation is based on years of operation from 1910-1988. I have further considered the allocation for the SFZ.

A 1986 report prepared for Exxon noted that, prior to the 1950s, "this area of the refinery was periodically flooded by the Mississippi River. To prevent this periodic inundation and to allow productive use of the area, fill materials have historically been placed throughout the area to elevate the land surface." The report further states that "a significant source of fill material consisted of silt removed from river water used in the refinery for once through cooling. The river water was typically comingled with oily wastewaters and/or oily sludges in a large 'silt' impoundment in the western sector of the refinery."[99] This silt impoundment would appear to be the Old Silt Pond, discussed above, which was not placed into service until October 1945. This is consistent with aerial photographs that show that it was only after the 1942-1945 period that much of the southern portion of the SFZ apparently was filled and put to use.[100] Thus, much of the SFZ appears to stem from Exxon's election, after the end of WW II, to use fill from areas that it knew or should have known contained contaminants from the refinery. Other units placed in service after the period of government involvement may also be a source of contamination in the SFZ.[101]

Aerial photographs offer inconclusive evidence on whether the SFZ was impacted by any filling prior to the end of WW II. If the Court finds that contamination and response cost impacts for the SFZ can be attributed to filling that occurred during the WW II period and included contaminants contributing to groundwater contamination, a reasonable allocation basis would be a years of operation, beginning in 1941, with the possible start of filling activities through and including 1987, when Exxon began implementing corrective action and monitoring measures. During this time period, Exxon conducted extensive operations and added various impoundments and waste treatment and storage units on the SFZ, which may have given rise to contamination.

[98] June 18, 2012 Gravel Report, at p. 218.

[99] Shallow Fill Zone Hydrogeologic Investigation, ERM-Southwest, October 31, 1986. BRTECH-00002158, at 2160.

[100] August 10, 2012 Mary Sitton Report, (Analysis of aerial photographs), at p.15.

[101] See, e.g., a 1987 Louisiana Department of Environmental Quality Compliance Order noted that the "severe cracks in the side walls below grade oil-water separator tank…..provide an opportunity for wastes to migrate into the environment." Compliance Order, February 5, 1987. BRC-00022877, at 22878.

D. Speculative Future Costs

Exxon has also proposed allocations for what appear to be unknown and highly speculative future costs relating to possible contaminant contribution of the Baytown and Baton Rouge refinery and chemical complexes to adjacent waterbodies. For the reasons stated in my prior reports and declaration, in my opinion, it is premature to attempt to determine an appropriate allocation for these waterbodies given that Exxon has not presented any information on the nature of any contamination that may require investigation or remediation. Not knowing what contaminants may be required to be cleaned up and having absolutely no idea what form any as yet unknown remediation might take makes it almost impossible to determine the extent to which the operations of the refineries and chemical plants during different periods may have contributed the contaminants that are present in the waterbodies. Furthermore, Exxon has produced little effluent data that would provide a basis for a credible analysis of discharges over time. Nevertheless, given that the issue has been presented to the Court, in my August 10, 2012 report, I presented what I believe can be only considered as the roughest outline of allocations for these for future costs potentially relating to remedial work in waterbodies. In this section, I discuss revisions or updates, if any, to my August 10, 2012 allocation opinions. Any revisions discussed below are in addition to the adjustments discussed in Sections IV and V, above.

1. Baytown

a. Scott's Bay

Scott's Bay is impacted primarily by the three Rubber Reserve Plancors both during the 1942-1955 period and the years thereafter when Exxon acquired and owned the plants. I am not aware of any documents in the record detailing the operations of these plants after they were acquired by Exxon. In my August 10, 2012 report, my allocation was based on time of use, assuming that each year of the Plancors' operations could have contributed equally to the contamination from the Scott's Bay outfall that was used for the plants' industrial process wastes from 1943 to 1969. Based on evidence in the record, I assumed that the Plancors continued to discharge stormwater through the Scott's Bay outfall after 1969 and weighted each year after 1969 by 10 percent. That produced a percentage share for the government of 21.69%. In addition to the adjustments in Section IV and V, above, I have adjusted this percentage to include an increased share (from 50% to 100%) for Plancor 877, the Copolymer Plant, to account for the fact that Exxon was not involved in operations of this plant. This plant appears to have accounted for approximately 50% of the discharge attributed to the three plants during 1943-1955. The resulting total government share for all Planors for Scott's Bay is 81.25%, calculated as follows:

	Govt. % Individual Plancors	Discharge (Response Cost Impact %)	Total Govt. % for all Plancors
Plancor 877	100.00%	50%	50.00%
Other Plancors	62.50%	50%	31.25%

81.25%

With the adjustments as noted, the calculation produces an overall allocation share of 35.22% for the government for speculative future costs related to Scott's Bay.

b. Houston Ship Channel, Black Duck Bay

The Houston Ship Channel is impacted by various releases and discharges from the refinery, including discharge from the main outfall (which changed locations after approximately 1967) and, at least one other refinery outfall, as well as releases and spills from dock operations, ship traffic, accidental releases, explosions and bypass flows from major storms. In my August 10, 2012 report, my allocation was based on annual crude throughput adjusted to account for improvements in the quality of the effluent discharged by the refinery. It produced a calculated percentage of 7.71%. In 2013, I notified counsel for the Department of Justice, who, in turn notified counsel for Exxon that the calculation in my spreadsheet contained an error and that the corrected calculation produced a government allocation percentage of 1.52%. This was a simple spreadsheet error – no change in analysis was involved at that time.

In my August 2012 discussion, I noted that the record contained snapshots of data that showed reductions in the measured or permitted oil and grease content in effluent from the main outfall during various years, including the most recent permit issued to Exxon in 2011. Based on this very minimal snapshot of data, which did not address any additional contaminants that might be expected to be found in sediments in the Houston Ship Channel (such as phenols, chlorinated solvents, PAHs, etc.) I applied response cost impact multipliers of 50% (from 1956-1969) and 25% (from 1970 to 2011). Although the permit limitations may suggest that the waste reductions in oil and grease were greater than those represented by these adjustment multipliers, I believe these adjustments are reasonable given that effluent limitations do not account for all of the releases from the refinery. As noted above, in many cases, refinery wastewater was released into the waterbody without treatment. It was also noted that surges of stormwater increased flow by up to 40 times, preventing oil from separating out and releasing significant quantities of oil into the Houston Ship Channel.[102] As the refinery increased substantially in size and complexity, the amount of stormwater and the potential for releases and spills from dock and ship operations could have increased.

However, in reexamining my allocation calculations and available effluent discharge data, I now am of the opinion that since the volume of effluent did not increase commensurate with the increase in crude throughput, it is more appropriate to apply the waste reduction multipliers to a time of use calculation – which begins by treating each year equally and produces an outcome more favorable to Exxon. I have incorporated this adjustment into my revised analysis, which produces a share for the government of 1.93%.

[102] 1970 Exxon Memorandum. BAYC-00000315, at 317.

c. Mitchell Bay

My August 10, 2012 report assumed that an outfall into Mitchell Bay was utilized by Exxon from 1928-1953 and discharges were limited to that time period. Based on documents subsequently discovered in the record indicating that seeps from beneath tank farms were entering Mitchell Bay at least into the late 1960s,[103] I have extended the time period to 1969. I have used an adjustment factor of 5% for the years after 1953 to account for the likely lesser volume of releases after the outfall was no longer in use. I have also used a time of use starting point to account for the fact that the volume of discharge through the outfall and from seeps was not demonstrably commensurate with changes in plant crude throughput. The calculations produce a government share of 3.25%.

2. Baton Rouge

a. Mississippi River

For the reasons outlined above for Baytown effluent, it is not clear that effluent volume is commensurate with increases in crude throughput. The record contains even less information on effluent parameters for Baton Rouge than it does for Baytown. Accordingly, I have used the same waste reduction multipliers, but applied them to a time of use basis – which eliminates the disadvantage to Exxon arising from the increased crude throughput.

b. Monte Sano Bayou

I have not made any additional changes to the allocation for the Monte Sano Bayou.

3. Additional Considerations Regarding Allocation of Future Costs

I provide the calculations above because I note in the Court's Summary Judgment Opinion that no decision has yet been made about whether to allocate future costs now, and I feel obliged to offer what thoughts I can that might assist the Court should it choose to do so. But I am at pains to note that I do not advocate allocating shares at this point unless there is some overwhelming reason to do so. As I discussed extensively in my November 16, 2012 report,[104] my years of experience suggest that investigations of the contaminants in the waterbodies will almost certainly reveal information vital to producing a well-reasoned and equitable allocation. The information on contaminants that may require remediation is currently nonexistent and the information on contributions from the refinery and chemical complexes is, at best spotty. For example, given the significant growth of the chemical complexes, and Exxon's failure thus far to produce data on discharges and releases from these facilities into adjacent waterways after Exxon purchased them, in my opinion, it would be improvident at this point to allocate as yet unknown future costs related to the speculative sediment contamination in these waterbodies.

[103] July 13, 1967 Exxon Memorandum, BAYC-00000163, at 174.

[104] Low November 16, 2012 Report at pp. 28-29.

E. Clarification of and Minor Modifications to August 10 2012 Report Calculations

In this section, I include a clarification of various calculations attached to my August 10, 2012 report. In addition to the revisions stemming from the discussion in Sections IV and V, above, I also have made a number of minor changes to the calculations that were attached to my August 10, 2012 report.

1. Adjustments to Pre-1942 Years of Operation Basis to Reflect Lower Crude Throughput Volumes

In reexamining my application of the years of operation methodology, I determined that it results in the years prior to WW II being weighed more heavily based on the volume of crude throughput. I have adjusted these pre-WW II years to make them approximately equal to the average of the WWII crude throughput volumes. For Baytown, I have adjusted the 1928-1940 years by 0.7, and for Baton Rouge, I have adjusted the 1910-1940 years by 0.5.

2. "Recalibration" of Shares after 50% Reduction of Avgas Waste Load

Mr. White asserts several times in his rebuttal report that my framework is deficient because I had only allocated 93% of the Baytown World War II waste load after reducing the World War II Avgas waste load from 14% to 7%. He also notes that the value I used for "Other War Products" in the spreadsheet was 25%, notwithstanding the narrative indicating that I had assumed the waste load for "Other War Products" was 20%. These two items are related. In fact, I had performed a calculation to normalize[105] (or as Mr. White puts it, "recalibrate") the refinery crude throughput % of "Other War Products" and non-war products after reducing the Avgas waste load by the time of my August 10, 2012 report. That calculation resulted in a 21.63% normalized share for "other war products" and a 71.37% share for non-war products, in addition to the 7.00% share for Avgas. In applying this normalization result, in my August 10, 2012 calculations, I had increased the share for "Other War Products" to 25% as a further conservative estimate in Exxon's favor.[106] However, I can understand Mr. White's criticism, as I failed to explain the reason for entering the 25% (rather than 20%) value. I have used 22% as a rough estimate of the other war products' percentage of crude throughput.

3. Velasco Street Ditch Allocation Calculation

Mr. White pointed out a minor error in the calculation of the allocation percentage for the Velasco Ditch. The calculation has been corrected, resulting in a minor decrease in the calculated U.S. percentage.

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[105] To normalize after making in an adjustment to one percentage is to calculate an adjustment in other percentages so that the new percentages continue to sum to 100%.

[106] I incorporated similar assumption – in Exxon's favor – in the Baton Rouge framework.

4. SWMU Investigation Cost Group Allocation Calculation

Exxon has claimed costs for investigation of a number of Solid Waste Management Units (SWMUs). The list of SWMUs included units that were in operation during the period of government involvement and units that were placed into operation after the period of government involvement. In my August 10, 2012 report, I estimated that that approximately 50% of the SWMUs were in operation during the period of government involvement, for which the government can be allocated a share. With regard to the SWMUs that appeared to have been in operation during the period of joint Exxon/U.S. involvement, I calculated an average start and end date of 1931-1959. In my allocation calculations, I inadvertently used an average start date of 1938. I have revised the SWMU investigation allocation calculations to assume that the average SWMU operating period begins in 1931 rather than 1938 since the 1931 date is more consistent with my calculations than the 1938 date.[107] This revision results in a decrease in the calculated U.S. percentage for this cost component.

5. Canals Narrative Explanation

My August 10, 2012 report indicated that I was assuming a 1928-1994 timeframe for my allocation calculations. It was intended to read 1928-1995. The correction in the narrative does not result in any change to the U.S. calculated allocation percentage for this cost component.

6. Ordnance Works Allocation Calculation

In my explanation accompanying the allocation calculation for the Baytown Ordnance Works, I noted that I was assuming a 1942-1993 operating time frame for the Ordnance Works. In the calculation, I inadvertently used 1942-1990, giving a result that was slightly more favorable to Exxon. The revised calculation uses 1942-1993, resulting in a negligible decrease in the U.S. allocation percentage for this cost component.

7. Plancor Allocation Calculation

Mr. White notes that I used 6% to allocate the Plancors' impact on the refinery waste load although my calculations actually produced a 5% impact. Mr. White is correct. I did use 6% deliberately as a slightly more favorable estimate for Exxon. As noted in Section IV, my revised spreadsheet uses 7%, increasing the U.S. allocation for the Plancors' impact on the refinery cost components. In estimating the percentage due to the Plancors,

[107] I also made a minor correction to an entry pointed out by Mr. White which changed the calculated end date from 1959.2 to 1959.7 and I have used 1960 as the revised end date.

8. Crude Throughput Figures

Mr. White noted that I used a mix of actual crude throughput and crude capacity in my allocation calculations for unknown, speculative future costs for Duck Bay/Houston Ship Channel and for Mitchell Bay. He is correct, actual crude throughput figures were used for the years for which such data were available. Inasmuch as my revised calculations for these speculative future costs have been revised, and are based on years of operation rather than crude throughput, this issue is no longer relevant to my allocation framework.

3. CONCLUSION

This report contains a number of adjustments to my allocation calculations, including adjustments that I believe reasonably take into account the Court's Summary Judgment Opinion. Some of these adjustments increase the government share and some have the effect of reducing the government's share. However, taken as a whole, the suggested adjustments do not have a significant impact on my opinion regarding the government's allocation percentage.

Any allocation framework in a matter as complicated as this, with as many disputed facts and evidentiary gaps as are present here can, at best, serve as a guide that may help the Court to examine the implications of various factual determinations and their impact on the Parties' respective shares. I have attempted to evaluate and apply the facts as I understand them, to avoid making undue assumptions to account for evidentiary gaps, and to apply allocation constructs that I have used successfully in the past to achieve equitable outcomes.

The framework I have proposed rests on two primary overriding conclusions which I believe to be true:

- That the refinery operations during the 1942-1945 WW II period and the operations of government-owned plants during 1942-1955 did not have a significant impact on the response costs for closure and remediation of different areas of the refineries that are at issue in this matter. At both refineries, the wastes produced in connection with Avgas and other war products were not qualitatively different from those before or after the war, and very large increases in production after the war were offset to some degree by improvements in waste handling over time (though, in my opinion, Exxon's claims in that regard are both extraordinary and unsupported). At Baton Rouge, there is an additional observation that is dominant: the majority of costs for Baton Rouge are for units or areas of the refinery that were not impacted at all by WWII operations.

- That the government's share for its degree of involvement in the refinery operations should be limited to, at most, a share for the portion of crude throughput relating to Avgas and "other war products" during the four year period of WWII, as well as for a share of the minor response cost impact of the government-owned plants during 1942-1955. That is, because the refinery operated to make a large product inventory both before and after the period of government involvement, I do not believe that Exxon's

proposal to treat all of these other items as "mere byproducts" of the production of Avgas can be justified.

If these two conclusions are accepted, the result is an allocation of a small percentage to the government. This is, however, not due to any particular allocation technique or structure I have adopted. Rather, in my opinion, it results from the very short period of government involvement at the two refineries, large production increases in the post-WW II period, and the lack of evidence available to support Exxon's more extreme proposals with regard to the response cost impact of waste reductions after the war on the particular units and areas for which Exxon is claiming past costs.

The most challenging aspect of this updated report has been an attempt to take proper account of the Court's Summary Judgment Opinion. Given the Court's suggestion that the United States was not an operator of either refinery during the War (even as the Government remained liable as a result of the related determination about the Chemical and Refinery operations constituting one facility) and suggestions in the Opinion that the Court would account for this determination at the time of allocation, it is challenging to determine how I might provide a supplemental opinion without simply imposing my own subjective view, and thus invading the province of the Court. I believe my original allocation framework, which factored the response cost impacts of government-owned plants into the calculation of the government's allocation percentage, is generally consistent with the Court's SJ Opinion. If the Court deems it appropriate to allocate a share to the government for response cost impacts of refinery operations, then I believe my original opinion, limiting the government's share to response cost impacts that can be attributed to the production of Avgas and "other war products" at the refineries also is consistent with the Court's opinion. Whether and to what extent the government's share of the response cost impacts attributed to Avgas and other war products should be reduced from the percentages I recommended in my August 10, 2012 report is a determination that I believe should be left to the Court, though I have tried to offer observations that may assist the Court as it considers the issue. My allocation calculations accompanying this report do not incorporate a reduction.

As I explained in my 2012 report, I chose a time of use model for allocation in large part because it did not appear that the facts required to reliably support the adjusted crude throughput-based construct like that Mr. White chose were available in the record. In particular, I do not believe that the waste reduction multipliers applied by Mr. White to "adjust" the crude throughput can be justified.

On the most basic level, assuming a 1995 endpoint, the WW II years represent only 4 years out of 75 years of operations at Baytown (or 5.3%) and 85 years at Baton Rouge (4.7%). Even if these percentages were split 50/50 across the entire refinery throughput (as opposed to just Avgas or other war products), it would amount to a government share related to refinery operations of 2.65% for Baytown and 2.35% for Baton Rouge. The impacts of the government-owned plants during the 1942-1955 on the actual costs at issue were minor and would increase these percentages only minimally. But since the government should not be allocated a 50% share of the entire refinery operation and since the majority of claimed costs at Baton Rouge

were for units not in use during WW II, in my opinion, government shares of no more than 2-3% for Baytown and 1% for Baton Rouge are justified. [108]

Matthew Low

[108] Combined with the other adjustments I have recommended in this report, the calculated government allocation percentage for Baytown slightly exceeds 2% which would cause me to revise my opinion that the government share should not be more than 3%, rather than not more than 2%, as stated in my August 10, 2012 report. If the Court reduces the 50% government share for Avgas output during WWII and the 40% share for "other war products" output during WWII, it would likely cause the calculated government share at Baytown to be lower than 2%. For this reason, I am recommending that the government share not exceed a range of 2-3%.